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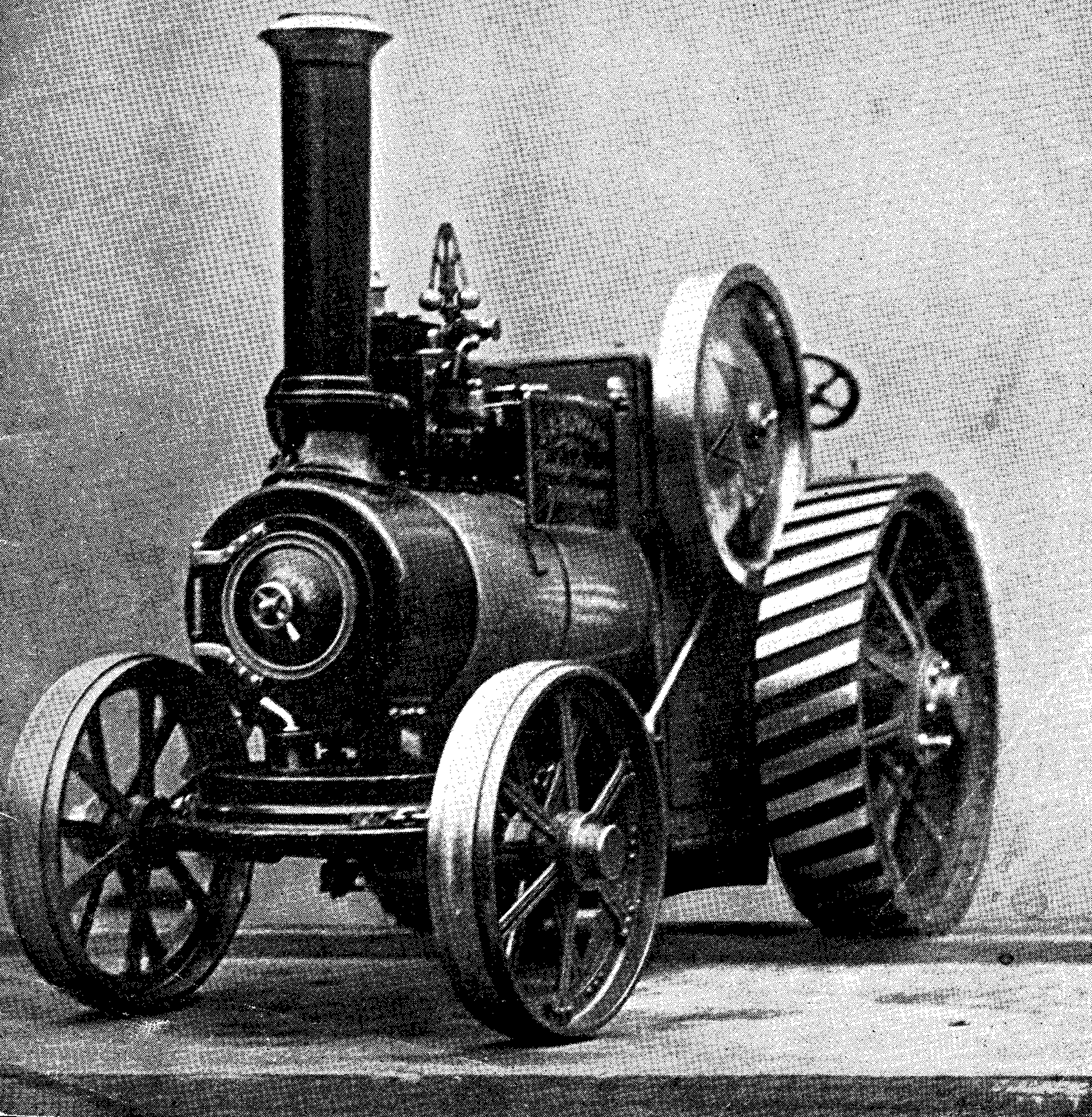

The MODEL ENGINEER

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5TH JULY 1951 VOL. 105 NO. 2615

SMOKE RINGS

Those Early " Wireless " Articles

● ELSEWHERE IN this issue we publish a most interesting letter from Mr. B. Binyon, O.B.E., M.A., M.I.E.E.; it speaks for itself and we have no intention of commenting on it. But we are now more than ever convinced that THE MODEL ENGINEER *was* the first periodical to publish information which enabled amateurs and even schoolboys to construct apparatus with which they could transmit and receive wireless signals.

We clearly recall that the development of wireless telegraphy was very rapid in those days, and only a few years later, Marconi had succeeded in establishing two-way transmission across the Atlantic. We also have every reason to remember some very intensive experiments in short-wave transmission, fifty years ago, carried out by two amateur investigators, the late Mr. Nevil Maskelyne and the late Mr. William Sharman, at Wandsworth Common. The distance over which they regularly " conversed " in Morse code was about 350 yards. Mr. Maskelyne was the father of the present " J.N.M." of the " M.E.," but his son's interest in the wireless transmission of " messages," in code or otherwise, would seem to have been damped out at a very early age! The apparatus in that house at Wandsworth Common could be very terrifying, especially during a thunderstorm! We regret, however, that there is no definite evidence as to whether the information for the construction of any of that apparatus was gleaned from THE MODEL ENGINEER; we rather suspect that it was not, for both the gentlemen concerned were of an inventive turn of mind.

Model Power Boat News

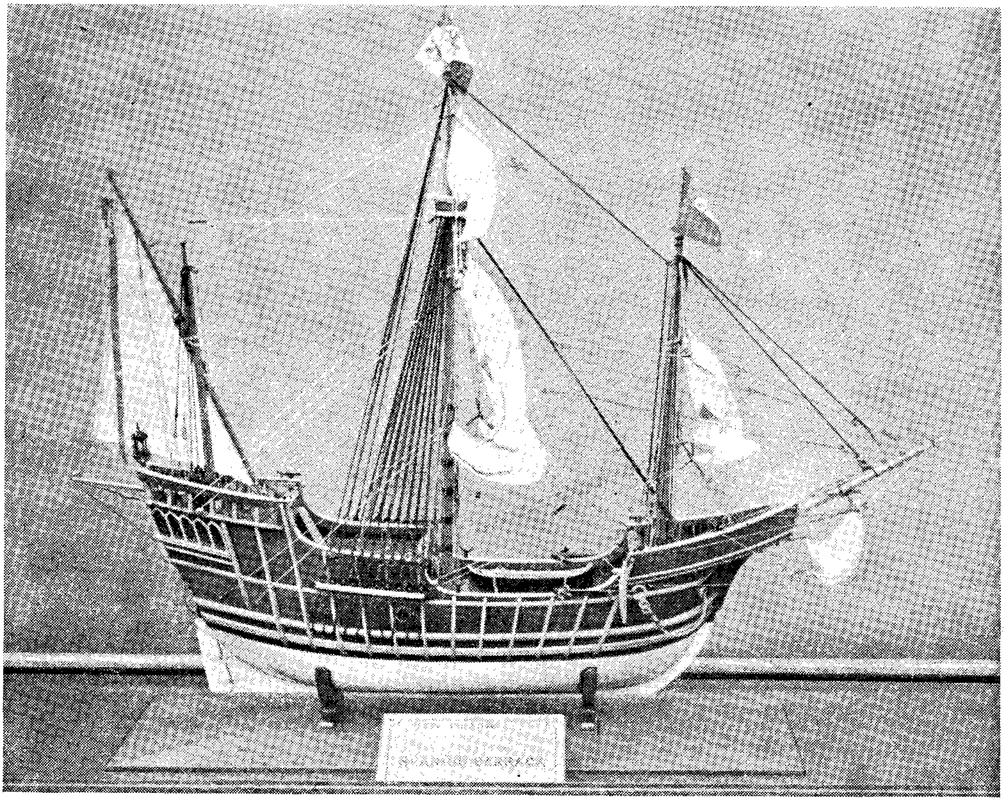
● THE MODEL power boat fraternity are among the most active and progressive of our readers, and we have always done our best to give them proportionate representation in the pages of THE MODEL ENGINEER by publishing reports of regattas, and items of technical interest in connection with this class of model. The model power boat movement, however, has now grown to such large proportions that regattas are taking place nearly every week during the summer season, and it becomes extremely difficult to find sufficient space to report all these regattas in detail. We have, therefore, arranged with our model power boat contributor to adopt a somewhat different method of furnishing our readers with up-to-date information on model power boat activities in the form of more general articles, including current news and observations on the progress of the hobby. In this way, we hope to be able to give model power boats the representation they deserve and, at the same time, avoid lengthy news articles which might encroach on the space demanded by the very numerous other aspects of model engineering.

The West Midlands Rally

● THE ANNUAL Rally which was held recently at Campbell Green, Birmingham, was very well supported, in spite of the bad weather, by 14 societies which, during the weekend, ran 12 locomotives carrying some 300 passengers. In addition to members of the federated societies, the number of visitors attending the rally compared very favourably with last year's figures, thereby proving that model engineering, and club activities in particular, are thriving in the Midlands.

The Annual Challenge Competition was held at this rally, and 11 entries were received from six societies. The winner was Mr. S. A. Howard, of the Sutton Coldfield and North Birmingham Model Engineering Society with his 1-in. scale traction engine (see the photograph reproduced on the cover of this issue), which won 79 out of a possible 100 points. Second in the competition was Mr. A. E. Field, of the Birmingham Ship Model Society, with his 16th century Spanish Carrack, which won 78 points, and third was Mr. C. E. A. Cook with his representative Burrell showman's engine, which won 76 points. The replica cup was presented to last year's winner, Mr. V. H. King, of the Marston Green M.A.A.C., for his $3\frac{1}{2}$-in. gauge "Hielan' Lassie." Judging was carried out by Messrs. J. I. Austen-Walton, Edgar T. Westbury and E. W. Bertenshaw.

Mrs. Austen-Walton officiated in the presentation of the prizes and the Championship Cup was received by Mr. C. F. Palmer, honorary secretary of the Sutton Coldfield and North Birmingham Model Engineering Society, in the unavoidable absence of the actual winner.



The 16th century Spanish carrack by A. E. Field which won second place in the West Midlands Challenge Competition

Unsolicited !

● AMONG the many appreciations we receive for the services rendered in our queries and replies service, we think the following, from a North Country reader, is worth while quoting verbatim and without comment.

"I sent my first query to you on June 11th. The only enclosure was a stamped addressed envelope—no fuss with coupons and no charge made. By return post I received a most comprehensive and helpful answer. In these days of 'couldn't care less,' this is indeed service, and I do congratulate you. I hope that I, at least, will not impose on your goodness, since you make it all too easy."

Model Power Boat News

by "Meridian"

A new "A" class record is claimed for "Gordon 2" by Mr. E. Clarke (Victoria)

THE decision of the M.P.B.A. to make silencers compulsory on all racing boats was not terribly popular when it was made about two years ago, but it has resulted in a strengthening of the position of many model power boat clubs in regard to the noise question.

Increased co-operation has been forthcoming from many local authorities, and in fact many clubs have been asked to run special regattas in conjunction with local Festival of Britain activities during 1951. It cannot be denied, however, that some racing boats are still rather noisy, and in this connection it is interesting to note the recommendations of the committee of the M.P.B.A. regarding silencers. For four-stroke engines, the Burgess type is accepted, and for two-stroke engines the following formula is urged.

1. Expansion chamber to be at least 3 times the capacity of cylinder.
2. No direct outlet, gas to change direction and/or have baffle interposed.
3. Final exit not to exceed total area of exhaust ports.

It is a very difficult thing to find a design that is really efficient in reducing noise and yet not affect the engine performance. Most of the silencers at present in use are effective in reducing the worst of the noise level, but more research into silencers is wanted. If any readers have evolved a good design of silencer it would be of help if it could be described for the benefit of power boat enthusiasts.

An interesting silencer seen recently was made by Mr. Butcher of the Victoria M.S.C. It was fitted to a "Hornet" engine of 10 c.c. and took the form of a double expansion chamber —one immediately behind the other. As regards silencing, it was very good, but since the boat is a new effort, it is too early to ascertain the effect on engine performance.

Although the regatta season is not yet — at time of writing—in full swing, several new record claims have already been sent to the M.P.B.A. for official approval. A new Class "A" record of over 63 m.p.h. is claimed by E. Clarke of the Victoria Club with *Gordon* 2, and R. Phillips of S. London has increased his Class "C" record to 62.7 m.p.h. with *Foz II*. It is pleasing to note that the Class "A" hydroplanes still retain their pre-war popularity in spite of the number of smaller classes now recognised for racing. Several new 30 c.c. engines are being constructed by well-known exponents of speed, and some may be ready for trial runs soon.

Recent Regattas

The Annual Regatta of the Victoria M.S.C. attracted entries from the Bournville, Swindon and Southend Clubs, besides good support from

the nearer clubs. Although the "Gremlins" were at work in the speed events, an enjoyable day's sport ensued.

The Southend Club did well in the straight-running events, as they specialise in this type of craft. An impressive model is Mr. Dowling's battleship *King George V*, the motive power being a small compression ignition engine geared to the propeller shaft; this results in a nice speed without overloading the engine.

In the speed events, the most outstanding performance was a run of nearly 55 m.p.h. by Ken Williams, with *Faro*, and 50 m.p.h. was exceeded by all winners except the "D" class race.

Results :

Nomination Race 80 *yd.*

1. A. Evans (Victoria), *Maycock* : 3.2 per cent. error.
2. Mr. Dowling (Southend), *King George V* : 6 per cent. error.
3. Mr. Lovatt (Victoria), *V9* : 9 per cent. error.

Steering Competition

1. Mr. Richard (Southend), *Three Isles* : 15 pt.
2. W. Hood (Swindon), *Truant* : 11 × 3 pt.
3. C. Morgan (Kingsmere), *KM7* : 11×0 pt.

500 *yd. Class "D" Race*

1st. Mr. Everett (Enfield), *Jaffa* : 26.88 sec., 38 m.p.h.

No others finished course.

500 *yd. Class "C"* Restricted

1st. Mr. Butcher (Victoria), *Day-Zee* : 27.54 sec., 37.1 m.p.h.

500 *yd. Class "C" Race*

1st. R. Phillips (S. London), *Foz II* : 19.59 sec., 52.2 m.p.h.

No others finished course.

500 *yd. Class "B" Race*

1st. G. Lines (Orpington), *Sparky II* : 20.25 sec.

No others finished course.

500 *yd. Class "A" Race*

1st. K. Williams (Bourneville), *Faro* : 18.71 sec., 54.7 m.p.h.

2nd. J. Innocent (Victoria), *Betty* : 21.13 sec., 48.3 m.p.h.

3rd. A. Cockman (Victoria), *Ifit 7* : 21.31 sec., 48 m.p.h.

Enfield Regatta

The first M.P.B.A. Regatta of the Enfield and District S.M.E.E. was held on the new boating lake recently opened at Albany Park, Enfield, and received good support from a number of clubs.

In the speed events, E. Clarke (Victoria) recorded 54.4 m.p.h. with his Class "A" boat *Gordon 2*, and as the regatta ended in good time, was allowed to attack the 1,000 yd. record, at present standing at 49 m.p.h. On the second of two attempts the engine of *Gordon 2* seized and the boat capsized at high speed!

Another boat from the Victoria club was Mr. Clifford's *Blue Streak* which was absent from regattas for most of last season. This boat has

Mr. R. Phillips (South London) with his new "C" class boat "Foz 2"

a new hull, and looks very promising, although the short course used at Enfield did not suit it.

The Class "C" race had to be declared null, as there were no finishers. The above-mentioned shorter course (6 laps to 500 yd.) may have been largely responsible for this.

Results

500 *yd. Class "D" Race*

1. Mr. Everitt (Enfield), *Jaffa* : 35.52 m.p.h.
2. Mr. Everitt (Enfield), *Slo* : 33.6 m.p.h.

Nomination Race, 40 *yd.*

1. Mr. Chandler (Southend), *S.48* : 2.7 per cent. error.
2. A. Rayman (Blackheath), Yvonne : 3.3 per cent. error.
3. J. Benson (Blackheath), *Comet* : 8.3 per cent. error.

Steering Competition

1. E. Vanner (Victoria), *Leda III* : 9 pt.
2. Mr. Newcombe (Victoria), *Silver Foam* : 8 pt.
3. K. Duncan (Croydon), *Zoe* : 6 pt.

500 *yd. Class "C" Restricted Race*

1. Mr. Butcher (Victoria), *Day-Zee* : 39.61 m.p.h.

500 *yd. Class "A" Race*

1. E. Clarke (Victoria), *Gordon 2* : 54.41 m.p.h.
2. Mr. Fort (Victoria), *Zipp* : 16.44 m.p.h.

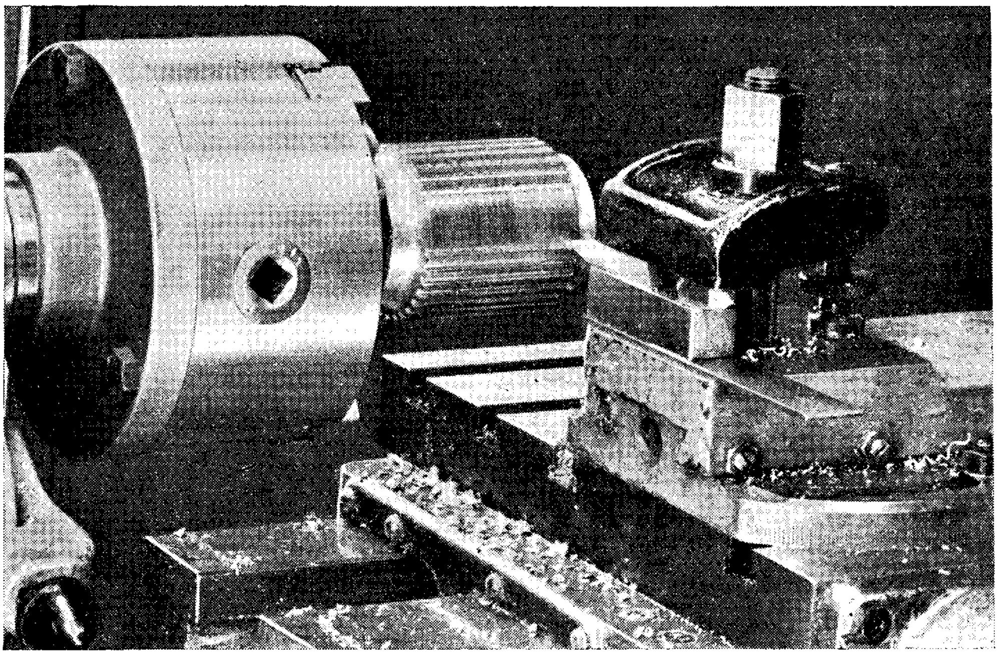
PETROL ENGINE TOPICS

*A 50-c.c. Auxiliary Engine

by Edgar T. Westbury

A GOOD many readers have discussed with me the question of friction drive, which is used by most of the engines employed as attachments to cycles. In the past, the use of this form of drive, not only on motor vehicles but also on many other types of machinery, has often proved to be inefficient or troublesome, and as a result, it has earned the opprobrious tag " bad practice " in the best engineering circles. I have been asked, therefore, to give my views on this matter, and if possible, to describe some form of " positive " transmission which could be applied to an engine of this type.

I have to tread very warily in delivering any dogmatic opinions on this subject, because we are dealing with a method of propulsion which is in a class of its own, and cannot be directly compared to that of any other motor vehicle. It may be said to be still in the development stage—one might even say the " teething " stage—and various commercial makers and individual experimenters have tackled the problem in ways that seemed to them best for the particular conditions. I would not like to prejudice the minds of readers by criticising methods which have been used in practice—the old saying that " there are more ways of killing a cat " applies here—but, as I said in the introductory article on this engine, the friction drive is the simplest which can be used in the particular circumstances, and gives reasonable success in transmitting the available power.



Planing the teeth in the friction roller

It is often assumed the positive drive must obviously be more efficient than that in which any possibility of slip can occur, but this is by no means invariably true, especially in cases where conversion of speed and torque is involved ; and even apart from actual efficiency, the question of convenience, either in application or control, must be taken into consideration.

Some years ago I worked in a shop where the boss had what might be described as a " positive mania " about power drive to machine tools. Belts or clutches were anathema to him ; every machine had to be driven from the motor by

*Continued from page 789, " M.E.," Vol. 104, June 21, 1951.

direct coupling or gearing. To cut a long (and painful) story short, he was eventually cured of his obsession, but not before a few motors had been burnt out, gears stripped, leadscrews twisted off, tools broken and work ruined. But in this class of work, the drive problem is much simpler than that of a mobile vehicle driven by an i.c. engine, and one may say that in the latter case, some form of "friction" drive (and this term includes friction clutches and belt drives) is practically a necessity.

The type of friction drive which involves direct contact of non-axial driving and driven members, either on the face, periphery or some intermediate angle, is of all types most open to criticism in respect of its ability to transmit torque efficiently, as the members have only line contact at best, and thus heavy pressure is necessary to secure reasonable adhesion when any substantial amount of power has to be dealt with. Nevertheless, such drives have been used with very fair success in motor vehicles, and they have been discarded less often for lack of efficiency or handiness than for their inability to stand up to the abuse they receive at the hands of careless drivers. Where it is possible to make one of the members of resilient material, such as rubber, something much better than the theoretical line contact is obtained in practice, and if such material can be made durable enough to give reasonable wear, the ultimate results can be, and often are, entirely satisfactory. Incidentally, every mechanically-propelled vehicle, unless it is driven by an aerial propeller or a jet motor, must ultimately rely on the "friction drive" provided by the contact of the driving wheel tyres with the road or track.

Readers may be assured, therefore, that I have not accepted friction drive simply because it is fairly popular, or without making practical investigation of its possibilities in comparison to other methods. The alternatives to friction drive must inevitably involve some complication at the very least. Belt drive has been very popular in the past, and can be made highly efficient; it became obsolete on motor-cycles mainly because of troubles with belt fasteners and tensioning devices, both of which objections could be eliminated by using modern endless belts. But direct (single-stage) belt drive from engine to road wheel is only practicable within a limited range of reduction ratio, and to obtain a sufficiently low gear ratio for the particular purpose in hand would call either for two stages of belt drive, or belt-cum-gearing. Much the same applies to chain drive, and a further complication in either case is that it is not easy to disengage the drive unless some form of clutch is added.

If any form of drive which applies torque to the cycle wheel, either through the hub or the spokes, is employed, it will almost inevitably be found necessary to strengthen the wheel structure to cope with the increased stresses produced by power drive. I know of more than one case where the spokes of the wheel have failed through neglect of this provision. There is yet another practical point in favour of the friction drive: so far from increasing the loading on the wheel bearings, as many people seem to believe, it actually relieves it, because a part of the combined weight of the rider, frame and engine is transmitted directly through the friction roller to the top of the wheel, instead of all having to be carried on the axle. This, of course, assumes that the roller is located at or near the top of the front or rear wheel, which is the most popular position.

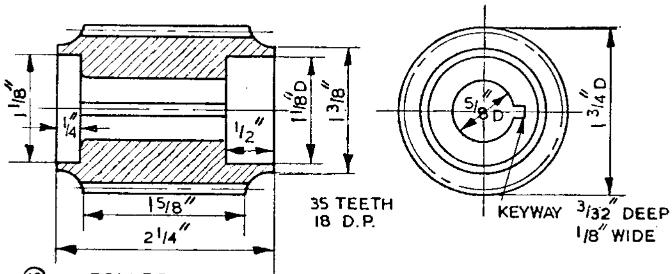
Various other details concerning engine position, centre of gravity and so on have been discussed with readers, but I do not consider it necessary to deal with them at present. The basic design of engine I have developed is sufficiently adaptable to enable readers who have any strong preferences about the way the engine should be applied, to exercise them to their hearts' content. The others, who are content to follow my recommendations, will find that they are quite capable of producing satisfactory practical results.

Friction Roller

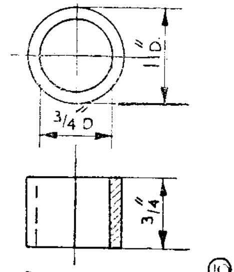
It would be idle to claim that complete finality has been reached as to the most suitable material for the roller; indeed, the manufacturers of cycle engines are as yet by no means agreed on this point, and all sorts of materials have been tried. The question is really a matter of finding the best compromise between three more-or-less incompatible factors, namely, durability of tyre, wearing life of roller, and avoidance of slip, especially on wet roads. I have made quite a number of experiments myself, but while these have not been conclusive, I do not wish to give readers the impression that the problem is likely to cause them a great deal of trouble; it is more a matter of searching for an ideal material than something which will work reasonably well.

Metal rollers give fairly good results and, generally speaking, the softer metals give best adhesion but wear out too quickly. The first "Busy Bee" engine had a cast aluminium alloy roller, but cast-iron has been found much more durable, although liable to acquire a hard glaze which encourages slip to some extent, particularly if machined to a smooth surface. By breaking up the continuity of the surface, the liability to slip is reduced, but there is risk of wearing out or damaging the cycle tyre if slip should under any circumstances occur. A very coarse but not too sharp knurl would drive well until the serrations became filled with dirt, which would not be very long. The best all-round results with metal rollers has been obtained by cutting straight grooves about $\frac{1}{16}$ in. to 3/32 in. wide, with lands of approximately the same width, axially across the surface. The roller grooved in this way is practically the equivalent of a gear wheel, though the tooth-form is not of any great importance.

Of other materials than metal, I have tried laminated fabric bakelite and bonded asbestos composition, both of which grip well, but results in respect of wear have so far been very disappointing. Abrasive-surfaced rollers give the best grip on wet roads, and are very durable, but solid abrasive wheels are difficult to mount truly and securely, and I have found that all forms of abrasive coatings so far tried have failed through imperfect bonding. However, experiments continue, and these materials seem to offer the most promising results if their inherent disadvantages can be overcome.



(12) ROLLER 1 OFF MATERIAL CAST-IRON



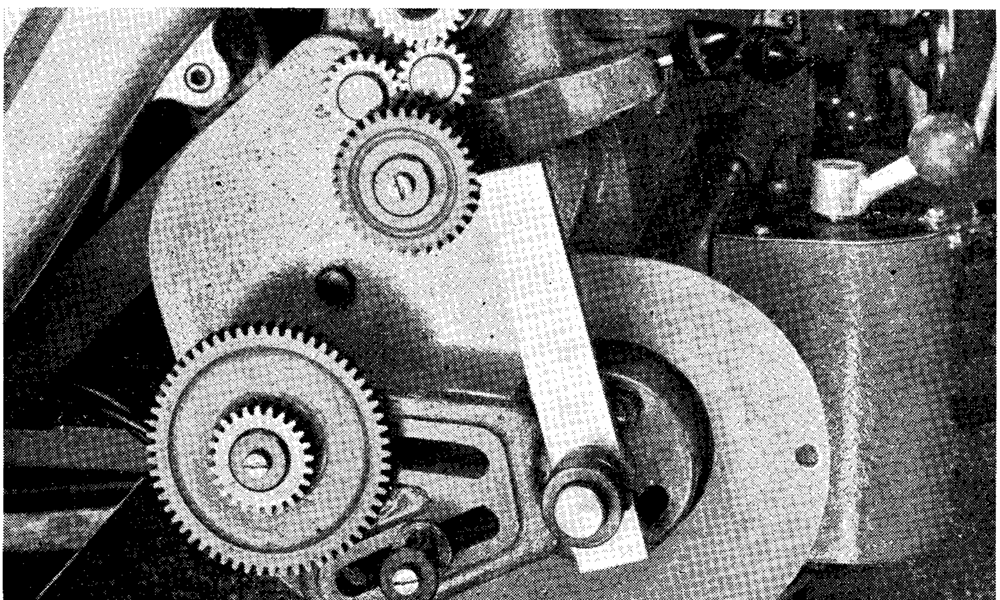
(10) BUSH 1 OFF MATERIAL BRONZE OR OILITE

The diameter of the roller, which influences the ratio of the drive, is also subject to experiment, but I have found that a roller of $1\frac{3}{4}$ in. dia. gives the best all-round efficiency with the engine power available, producing a speed of 18 m.p.h. at approximately 3,500 r.p.m. It should be noted that the size of the cycle wheel does not affect the ratio, as it forms merely an " idler " in the transmission system. If one neglects the effect of slip, the distance travelled by the cycle in one revolution of the engine is equal to the circumference of the roller, irrespective of the size of the cycle wheel, though the rotational speed of the latter will obviously vary in inverse proportion to its diameter, relative to that of the roller.

The machining of the roller is a fairly simple job ; it may be held in the four-jaw chuck for facing and recessing one end, boring to a neat push fit on the shaft seating, and roughing down the outside as far as can be reached, after which it is mounted on a pin mandrel for the remaining operations. It is best to chuck it with the deeply recessed end outwards, as this leaves less work at the second setting than if it is tackled the other way round. Note that these recesses act, in conjunction with the sealing bush at the inner end, and the boss of the magneto mounting plate at the other end, to form labyrinth packings for excluding water and dirt from the main bearings. They should, therefore, run with a small but sufficient clearance over these projections when fitted, and it should be remembered also that the deep recess accommodates the fixing nut as well, so it must be capable of admitting a tubular box spanner of the specified size ($\frac{7}{16}$ in. Whit.).

Cutting the internal keyway in the roller is carried out in the same way as that in the crank disc ; the work can be held for this operation in the three-jaw chuck, with its face bedded firmly against that of the chuck.

For serrating the outside of the roller, it should be remounted on the mandrel, and preferablv the



A simple method of indexing the lathe mandrel for spacing roller grooves

outer end of the latter should be supported by the back centre. The grooves can then be planed by means of a short, rigid tool held on its side in the toolpost, and operated by racking the saddle backwards and forwards. It is not necessary to be too meticulous over the tool form, but something approximating an involute tooth form helps to keep the roller free from clogging. Some form of indexing device is required for spacing out the teeth, though here again, precision is not highly important, and if one cannot divide up the circumference into 35 parts, the nearest readily divisible number will be suitable.

If no means of indexing the lathe headstock is available, the method shown in the photograph gives sufficient accuracy for our requirements. It will be seen that a 35-toothed changed wheel is mounted on the cluster gear stud, and a piece of mild-steel flat bar is shaped at the end to form a detent to engage the teeth of the wheel, and pivoted on the leadscrew, located between two collars. The tumbler gear is, of course, engaged in either direction, and in order to avoid inaccuracy caused by backlash in the train of gears, the lathe mandrel should be turned always in one direction, and held so as to press the teeth of the change wheel downwards into firm engagement with the detent. Personally, I always prefer to mount the index wheel directly on the lathe mandrel and use a close-fitting detent, so that backlash can be positively eliminated ; (this has been fully described many times in THE MODEL ENGINEER and can also be found in the handbook *Milling in the Lathe*) but the method illustrated is much simpler to rig up at short notice, and suffices for a job of this nature, though I would not recommend it for gear-cutting or other precision work.

Packing Bush

The most suitable material here is "Oilite," or some similar impregnated bearing material, but there may be difficulties in obtaining supplies under present conditions, and as a substitute, solid bronze may be used if care is taken to avoid seizure or "picking up" during the running-in period, as the clearance must be kept as small as possible. There is virtue here in what would normally be considered "bad"—that is, soft and porous—material. A cast-iron bush is also permissible. This bush serves the double purpose of a supplementary main bearing and a packing gland to prevent the leakage of air to and from the crankcase. It does not take any very great bearing load, though it does steady the shaft, and experience has shown that its fit has an important influence on engine performance, as a good deal of mixture can be lost from a leaky bearing.

I have found that a plain bush is preferable for this purpose to the majority of the devices designed specially as bearing seals, and it imposes less friction on the shaft.

The use of a plain parallel bush, having no positive endwise location, may possibly be open to question, but the reason for it is that it is desirable to use a ready-made "Oilite" bush, and no shouldered bush of a suitable size is available, so far as can be ascertained. It is possible to machine this material if due care is taken, but its relatively low mechanical strength makes it liable to crumble, and on the whole, it is generally best to use a moulded bush of the specified size.

The amount of interference allowed for an "Oilite" bush should be greater than that for a solid bronze bush—about 0.002 in. in the 1 in. dia. specified—and when pressing it in, the bore should be supported against risk of collapse by means of an internal mandrel the same size as the shaft. It should be clear of the inner ring of the ball-race when inserted.

Though not specified in the drawings, I have found it advisable to fit a locating grub-screw to guard against shifting of the bush, but this should not bear hard on the latter to cause distortion.

(To be continued)

The Derby Museum

In our issue for September 8th, 1949, we published a preliminary announcement of an important project then to be put in hand at the County Borough of Derby Museum and Art Gallery. On May 26th this year, the project completed was formally opened by His Worship the Mayor of Derby.

There is now a new technical and industrial section displaying, in striking and convincing fashion, the principal industries of the town ; the policy which has governed the planning and arrangement of the new section is to put strong emphasis on collections which are primarily and frankly of local interest, and to reduce the number of those exhibits which deal with miscellaneous natural history. This is a bold policy, but one which can easily be justified ; for Derby is an important industrial centre, motor-cars, wearing apparel, clocks and printing machines being among the many manufactures that are produced there.

To most "M.E." readers, however, Derby's prominence centres upon the fact that, since 1851, railway locomotives, rolling stock and other equipment have been produced at the great factory which was formerly the headquarters of the Chief Mechanical Engineers' Department of the Midland Railway. This fact is duly featured in the new section of the museum by a 7-mm. scale railway some 50 ft. long and built by the official staff in collaboration with members of the Derby Society of Model Engineers. Miniature replicas of typical products of Derby Works can be seen running on this railway, which represents, in its turn, a typical stretch of English railway ; and we can think of no better representative prototype than the old Midland Railway for such a purpose.

CONVERSION OF DYNAMOTORS

by E. Sweet

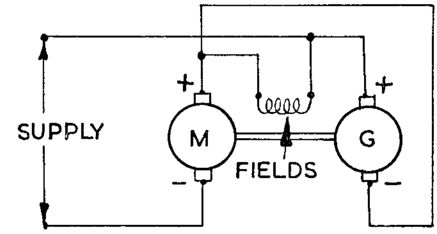


Fig. 1

THERE are many types of *ex*-Government dynamotors on sale in the surplus market. The usual way of running these units as driving motors is to connect the fields in series with the high voltage armature winding ; this has, however, many disadvantages. The speed characteristic is unsuitable—high speed at no-load ; also, it is not possible to use the low voltage output of the unit, as insufficient field strength prevents generation.

There is a system of connecting these units which will overcome both of these difficulties when used on d.c., and the first when used on a.c. This system of connection can best be described as series-shunt connection. The basic circuit is as shown in Fig. 1 ; while this may be suitable for some small motors, a modification is required for starting most types, because when the armature is stationary its L.T. winding short circuits the fields. Fig. 2 shows the starting connections.

The relay can be of the Post Office type, connected to make when current flows in its coil ; it should be of a suitable voltage for the L.T. winding. A point to watch when making the connections is that one pole of the H.T. winding must be connected to the opposite pole on the L.T. winding, leaving existing field leads in position. If the L.T. winding is coupled incorrectly, the motor will be found to race, with much sparking at the H.T. brushes. So far the motor will run well on d.c., but a further modification may be made for a.c. ; this is shown in Fig. 3. Calculation for one type of generator indicates that the capacitor must be about 1,000 *u* F. with a working voltage of about 50 V ; it may be possible to obtain a capacitor off an old induction motor for this.

The requirement for successful running on a.c. is that the current which flows in the fields as a result of the L.T. voltage must be in phase with the armature current. As the L.T. voltage is produced as a result of the field strength, it is reasonable to assume that it will be in phase with the armature current. However, on applying the voltage to the fields, the current will lag the voltage somewhat, but this will not be so serious as for 230 V fields. Calculations for one type of dynamotor, one with 300 m.A. H.T. winding, indicate that a phase difference of about 3 deg. is to be expected. If this is fairly accurate for most types, it would seem that a correction capacitor is not essential, and the circuit shown in Fig. 2 will be satisfactory.

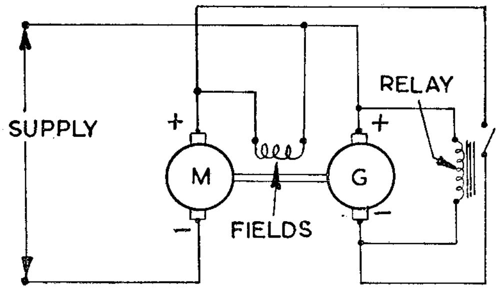


Fig. 2

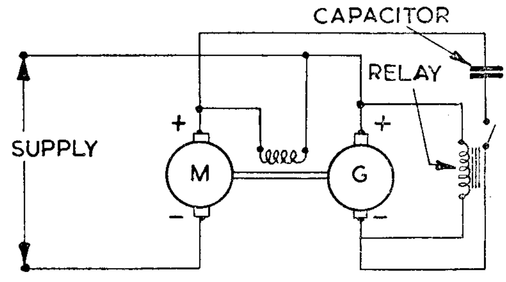


Fig. 3

*CAMERA CONSTRUCTION

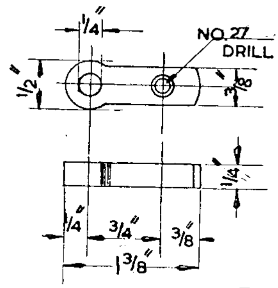
by Andrew Todd

WHAT I have concentrated on is a means of swivelling the back and front frames to any desired angle, and to be able to tilt the camera to any required position, and finally to be able to lock the various parts firmly in position, so that once set they will stay put.

All the parts are designed so that I can make them in my own workshop.

Part No. 1

The base consists of a 12 in. length of alloy bar $\frac{3}{4}$ in. diameter. A keyway is milled the length of the bar, and it is important that this is parallel to the axis of the bar, and that it is accurately finished. The ends of the bar are chamfered off; a groove is machined in each end to take part No. 2. These grooves should be in line with each other and at right-angles to the keyway.



THRUST BLOCK 2 OFF (2)

Part No. 2.—Thrust Blocks (2 off)

The thrust blocks are made in light alloy and should be a good fit in slots in end of bar. The hole in the block for 4 B.A. screw can be made to suit either a cap screw or countersunk, as shown in drawing. Before drilling the end of the bar to take this screw, the nut and feed screw should be offered up and set in their proper position.

Part No. 3.—Focussing-Screw. (2 off)

The screws can be made in brass or in duralumin; I prefer the latter. I suggest that the screws be made ten threads per in. I should not use a full depth of screw, but should make it about half of its depth, making the root diameter about 0.2 in. diameter. I do not think it necessary to make an adjustable thrust-nut to take up end play; I propose using the knob to take up the thrust and to hold it in position by a grub-screw.

Part No. 4—Nut for Above (2 off)

The nut can be made in the same metal as the screw. The same tool that made the screw can be used to cut a tap. The tap can be used to make the nut, as it is difficult to screwcut a nut of this diameter in the lathe. The nut is attached to the sliding block by a 6-B.A. screw and a $\frac{1}{16}$ in. dowel pin.

Part No. 5.—Knob (2 off)

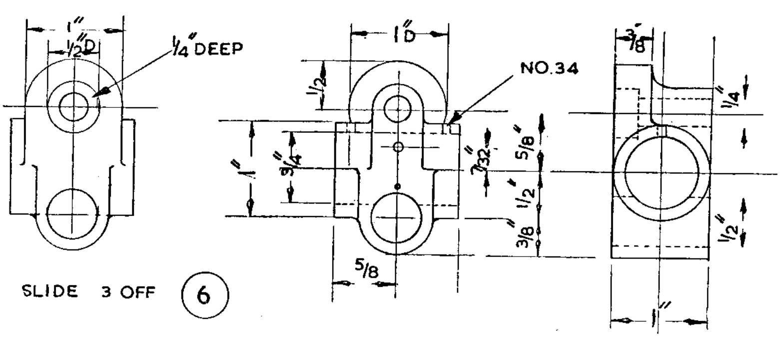
This is turned from a piece of 1 in. diameter aluminium bar. It is drilled and tapped in the boss to take a 6-B.A. grub-screw; the edge should be knurled with a diamond knurl.

Part No. 6.—Sliding Block. (3 off)

The easiest way to make these is to get castings of them. Failing this, they can be machined out of the solid. The blocks should be a good fit on the bar.

Part No. 7.—Locking-Screws. (3 off)

These are turned from $\frac{1}{2}$ in. diameter dural bar. They are screwed $\frac{1}{4}$-in. Whitworth. A $\frac{1}{16}$ in. diameter dowel pin is fitted close up to the head of bolt to prevent the collet from turning.

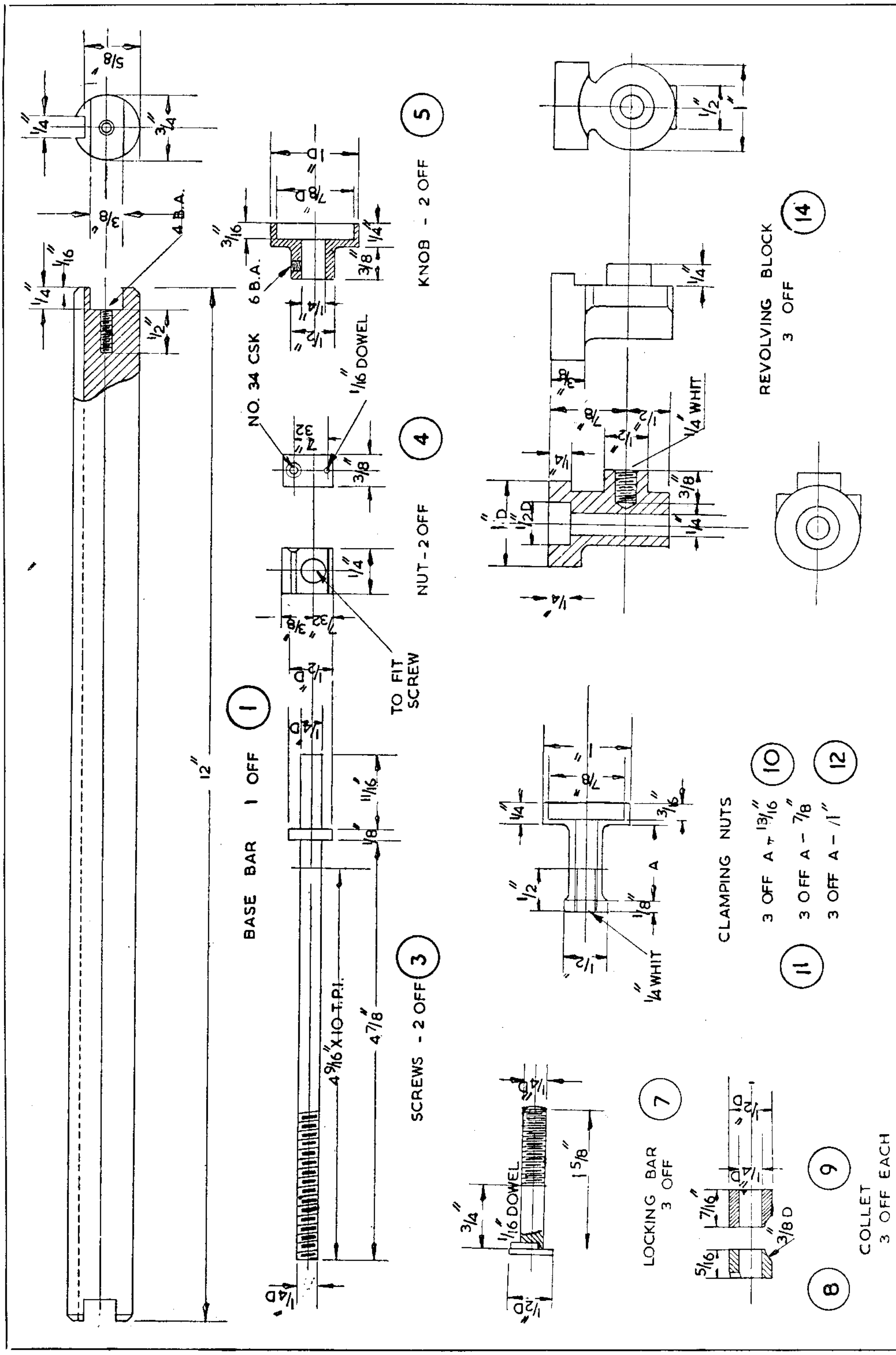


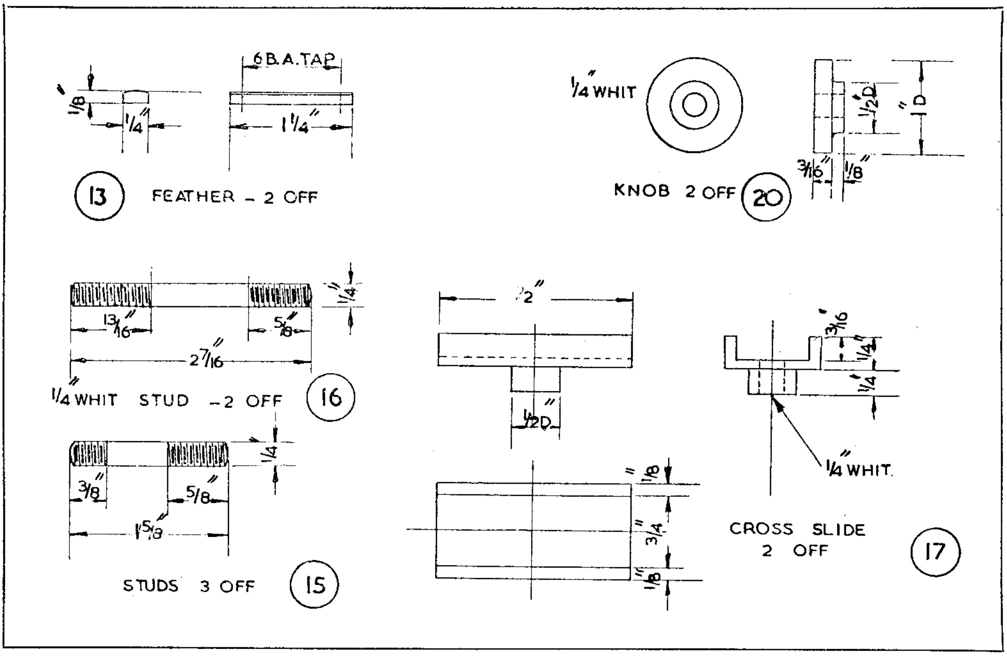
SLIDE 3 OFF (6)

Parts Nos. 8 & 9.—Collets. (3 off each)

These can be made in $\frac{1}{2}$ in. diameter bar. The three short ones should be a push fit on the bolts, and should have a slot cut in the end of them to fit the dowel on the bolt. The other three should be a nice sliding fit on the bolt.

**Continued from page* 827, "*M.E.*," *Vol.* 104, *June* 28, 1951.


BASE BAR 1 OFF
1
4 B.A.
12"
SCREWS - 2 OFF
3
4 9/16" X 10 T.P.I.
4 7/8"
NUT - 2 OFF
4
TO FIT SCREW
NO. 34 CSK
1/16" DOWEL
KNOB - 2 OFF
5
6 B.A.
REVOLVING BLOCK 3 OFF
14
1/4" WHIT
CLAMPING NUTS
10 3 OFF A - 13/16"
11 3 OFF A - 7/8"
12 3 OFF A - 1"
LOCKING BAR 3 OFF
7
1/16" DOWEL
COLLET 3 OFF EACH
8
9



Parts Nos. 10-12.—Clamping-Nuts. (3 off each)

These are made from 1 in. diameter bar. The edges are milled and a good finish should be obtained on them.

Part No. 13.—Feathers. (2 off)

The feathers should be a good fit in the keyway on the basebar. The two sliding-blocks should be assembled on the bar complete with the locking gear. They should be adjusted till they are absolutely square with each other and the keyway is in its proper position. This position is most important, and every care must be taken to get them right. The locking screws should be clamped up tight. The feathers are fitted in position, and holes for 6-B.A. screws drilled through the sliding-blocks into the feathers and screws fitted to them. The blocks should now be able to slide up and down the bar without any radial movement on the bar, very little pressure should be required to lock the slides on the bar. The third block should be mounted on the middle of the bar, and it is free to revolve on the bar if required. This block is mounted upside down to the other two blocks. The bar clamp being on the top instead of the bottom. This block is for mounting the camera on the tripod, and the camera revolves in it to take a horizontal or vertical picture as required.

The focussing screws should be fitted up, and the nuts located on blocks and screw holes drilled and tapped; holes for $\frac{1}{16}$ in. diameter dowels should also be made. The drilling for screws holding the nuts and thrust blocks should be done with the sliding blocks as near the ends of the bar as possible. It should now be possible to slacken the locking-nuts and screw the blocks up and down the bar without any tight or loose spots being apparent.

Part No. 14.—Revolving Blocks. (3 off)

Castings can be used for these or they can be carved from the solid. They should be a nice fit without any shake on the sliding block.

Parts Nos. 15 & 16.—Studs. (3 off each)

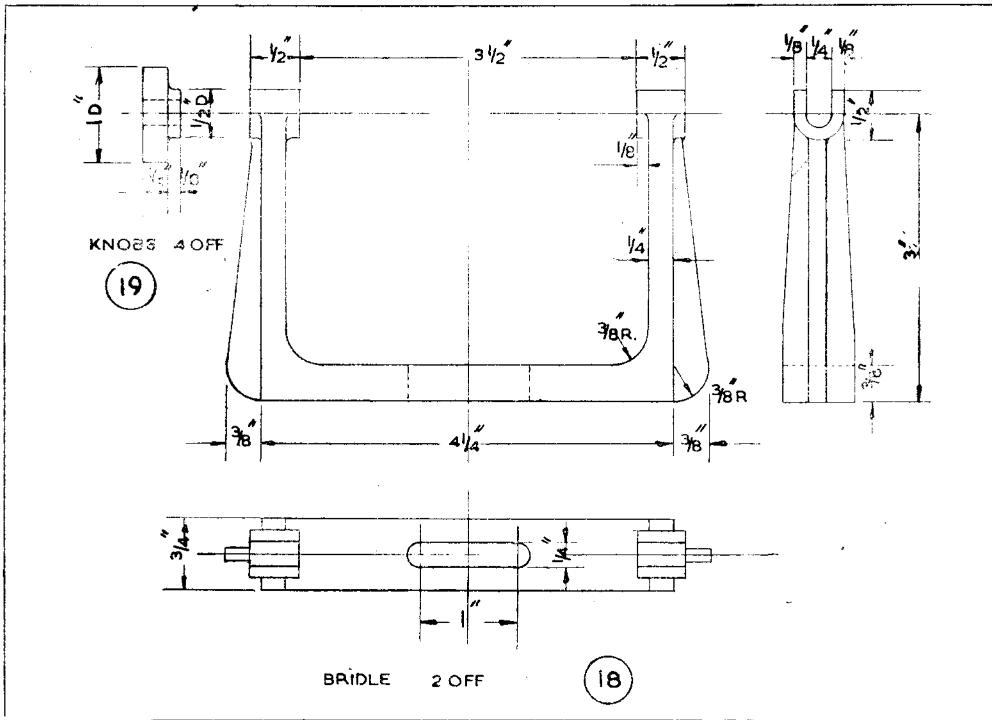
Use $\frac{1}{4}$ in. diameter bar for these; if duralumin is used, make all threads Whitworth. The studs should be screwed tightly into their respective blocks, and this part of the assembly completed. The edges of the mating faces of blocks can be engraved with index lines (as shown on drawing) to enable the lens and plate carriers to be set square with the bar and parallel with each other, or to be set at an angle to the bar and still keep them parallel with each other.

Part No. 17.—Cross-slide. (2 off)

The cross-slide carrying the U-shaped bridle is made in dural. I have not made any provision for a screw to operate this bridle. If I find it necessary, it is a simple matter to fit one on it. Nor have I made any form of adjustment for the slide—it is not a difficult job to machine the parts to fit each other. Index lines can be engraved on the edges to enable the two slides to be set parallel to each other. Lines can also be engraved on the top-side of the slide to set the bridles in line with each other.

Part No. 18.—Bridle. (2 off)

Castings may be best for these. I have shown the top of them forked instead of using a circular boss. The bellows and plate and lens carriers



can be removed instantly to fold up the camera as much as possible.

Parts Nos. 19 & 20.—Knobs. (4 and 2 off)

These will be turned from 1 in. diameter alloy bar.

This then is my proposed design for a camera suitable for the photography of models. I would like to hear readers' opinion of it, and if any reader cares to produce a better one I will gladly scrap my design and build his.

Pertinent Comments

In a long and very interesting letter from a Lancaster reader, there are some pertinent comments on our hobby and the "M.E."; he writes :—

"I have ceased to be an active model maker and have now no connection with the engineering profession, but continue to read THE MODEL ENGINEER, as it deals with many of the things with which I was brought up, particularly steam engines, marine, locomotive, traction and stationary.

"I was very much interested in Mr. Keiller's description of his compound locomotive; he gives chapter and verse as to why he did so and so, and it is a pleasure to read an article by one who so obviously knows what he is writing about yet makes no dogmatic statements.

"Our old superheated friend 'L.B.S.C.' is also a source of perennial interest. He is everybody's daddy at small machine shop practice. Why do you run a 'Novices' Corner'? It is all there in 'L.B.S.C.' that he who runs may read.

"I see one of your correspondents is of opinion that model car racing is not model engineering. I agree with him, but neither is camera making or domestic refrigeration."

We enjoyed this letter, but we feel that we ought to reply to the questions raised. First, we run "Novices' Corner" because we feel it is necessary, and it is now one of our most popular features, most of the hundreds of readers who like it and profit by it having no interest whatever in steam locomotives.

As to whether model car racing, camera making and domestic refrigeration are model engineering, this is largely a matter of opinion; but most people agree that any hobby entailing the application of technical knowledge and constructional ability, within the facilities provided by a home workshop, comes within the scope of our pages, especially if the results can be turned to domestic use. There is no hard and fast line on which to draw a distinction; it depends on a point of view.

A SIMPLE ELECTROMAGNETIC ENGINE

by H. R. Langman

THE earliest machines for producing motive power from the magnetic effect of electric currents are known as " electromagnetic engines," and depended on the interaction between electromagnets and masses of soft iron. In the more practical machines the energised electromagnets were stationary, and imparted either an oscillatory or rotary movement to soft-iron members, which in turn produced directly or indirectly continuous rotary motion of the main shaft.

In the electromagnetic engine about to be described, a small double electromagnet attracts a pivoted soft-iron armature, to the free end of which is jointed a short connecting-rod, the lower end of the rod being attached to a single-throw crankshaft supported in a long bush fixed to a bracket.

" Make and Break "

For controlling current to excite the electromagnet, a simple " make and break " is used, comprising a cam-shaped wiper on the crankshaft contacting with a stationary strip of flexible metal.

Since the model may be constructed from any suitable parts at hand, only the chief dimensions of the more important items have been given.

Referring to Figs. 1 and 2, *A* is the electromagnet obtained from an electromagnetic device such as a bell, relay, etc., the magnet being secured to a metal bracket *B* complete with foot for attachment to the baseboard *C*. To form an anchorage for the fulcrum-pin *D* of the armature *E*, a brass plate *F* may be drilled and forced over the core *G* of one of the coils of the electromagnet *A*.

To the outer end of the plate *F* is soldered a short length of brass tube intended to serve as a bearing for the pivot-pin (see 3).

The armature *E* is cut from soft-iron plate and bent to the shape shown (4), the pivoted end having two lugs bent at right-angles so as to fit over the brass tube carrying the pivot-pin. The pin-hole in the lugs is drilled so that the pin is a tight fit therein, but must be free in the brass tube.

A block of brass *b* is soldered or attached in some way to the armature, the block requires to be slotted at *c* for reception of the connecting-rod end. The joint-pin *d* should also be a tight fit in the block *b*.

The light alloy connecting-rod *H* is shown at (5); the bosses are bored to suit the joint pin *d* (4), and the crankpin respectively. Two small oil holes may also be drilled in the bosses.

The plain crankshaft *I* may be produced by carefully bending a piece of 5/32-in. steel wire; the shaft should then be thoroughly polished and entirely free of burrs, etc.; (6) shows the completed item. The crankshaft is supported in a long bush *J* soldered to an angle bracket *K*, the latter being attached to the baseboard *C* by wood-screws. A tubular rivet of suitable size may prove suitable for the bush, the flange being soldered to the bracket *K* (see also 7).

Contacting

Coming now to the contacting mechanism *L*, also shown in detail in (8). Mounted on the crankshaft is a brass cam *C* soldered to a boss *b* provided with a fixing-screw *a*. The correct length of contacting surface *f* can best be arrived at by experiment. The stationary part of the contacting arrangement consists of a bent brass pillar *d* to which is screwed a springy brass strip *e*. Adjustment of *e* in relation to the cam contacting surface *f* is effected by a screw *g*, the screw being locked by the nut *i*.

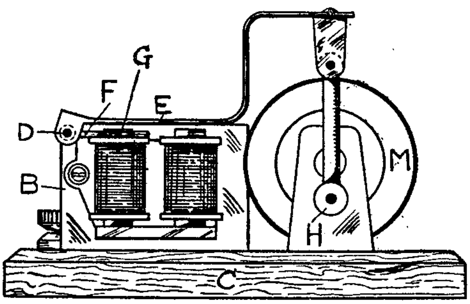


Fig. 1

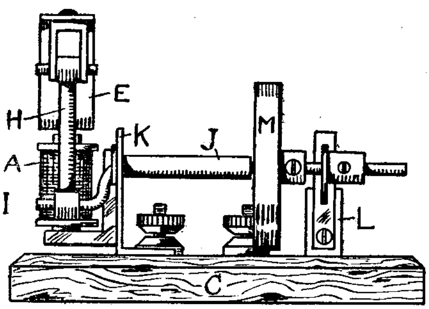
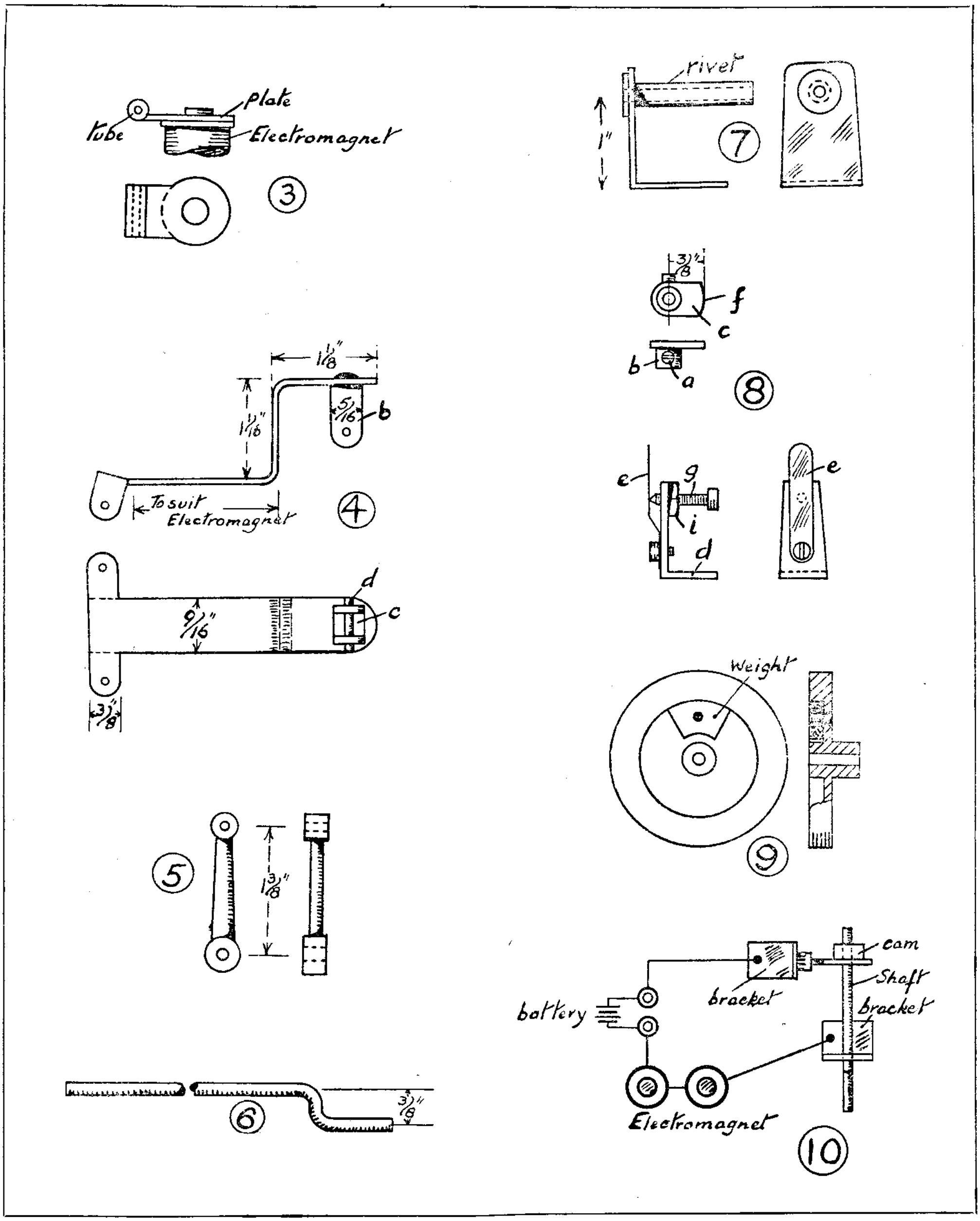


Fig. 2



A flywheel *M* of suitable weight is essential for smooth running of the model. If a recessed type of wheel be used, a small lead balance weight may be added to counterbalance the weight of the armature and it fittings (see 9).

When assembling the parts, ensure that when the crankpin is at the lowest point of its path, a small air gap exists between the electromagnet cores and armature. On no account must there be the slightest contact between these members.

The wiring up of the various components is shown at (10). Provided that electric bell-magnets or those of similar types are used, a torch double battery will be found capable of working the model at a good speed.

Finally, it might be mentioned that some constructors may prefer to mount the electromagnets horizontally, so that the connecting-rod vibrates in a horizontal plane.

TOOLS AND TOOL ANGLES

Terms and Definitions for Single-Point Tools

by S. F. Herridge

THE most efficient remover of metal is a well-designed single-point tool where resharpening and setting are held to the minimum.

While lathe tools are formally sharpened to the ideas and inspirations of tradesmen, today the tendency of standardisation is due to the work of the "British Standards Institution" and co-operating organisations who have condensed the foregoing shapes. A general grouping of these tools is :—

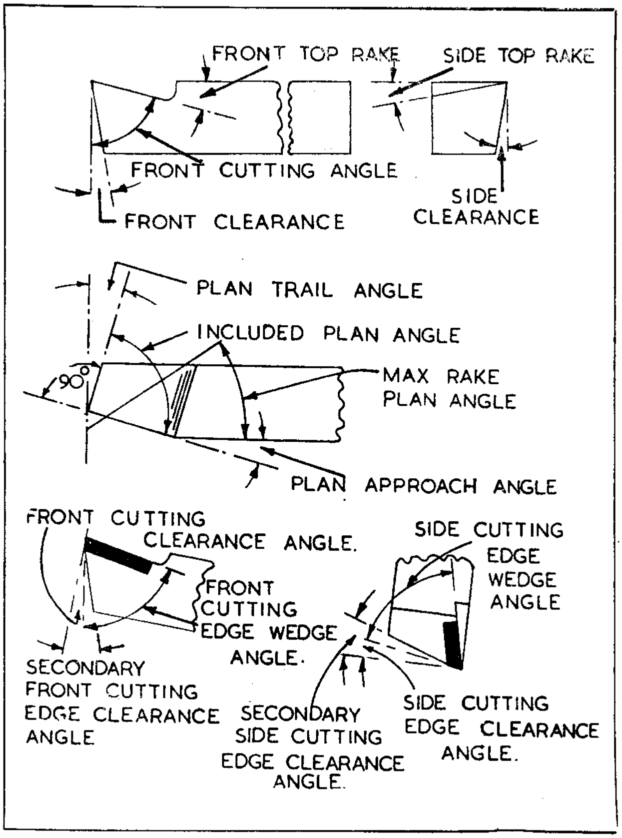
(*a*) The solid tool having the same material throughout.

(*b*) Butt-welded on to a tough steel shank.

(*c*) A solid type of tool carbide tipped.

(*d*) Circular type tools.

(*e*) Special tools such as form tools and diamond tips, etc., are not dealt with here.



Tool angles. These angles as required on each tool will vary according to the class of material to be cut. This is shown in the table. Top rake is noted in the standard forms as indicated on the drawing.

Plan approach angle has a marked influence upon the cutting speed and tool life from a given chip area. It is described as the angle between the side cutting edge and the side of the shank, measured in a plane parallel to the base. In the case of a bent tool this angle is measured from the straight side of the shank. Scale wherever encountered, irrespective of a type of material, causes abrasion to some extent, and in such cases adjustment to shape and rake may be necessary.

Plan trail angle. This is the angle between the nose or front cutting edge and a line at right-angles to the side of the shank, measured in a plane parallel to the base. On bent tools this angle is measured from the straight side of the shank. The plan trail angle should be as small as posible, providing maximum resistance to pressure at the tool nose in the direction of travel.

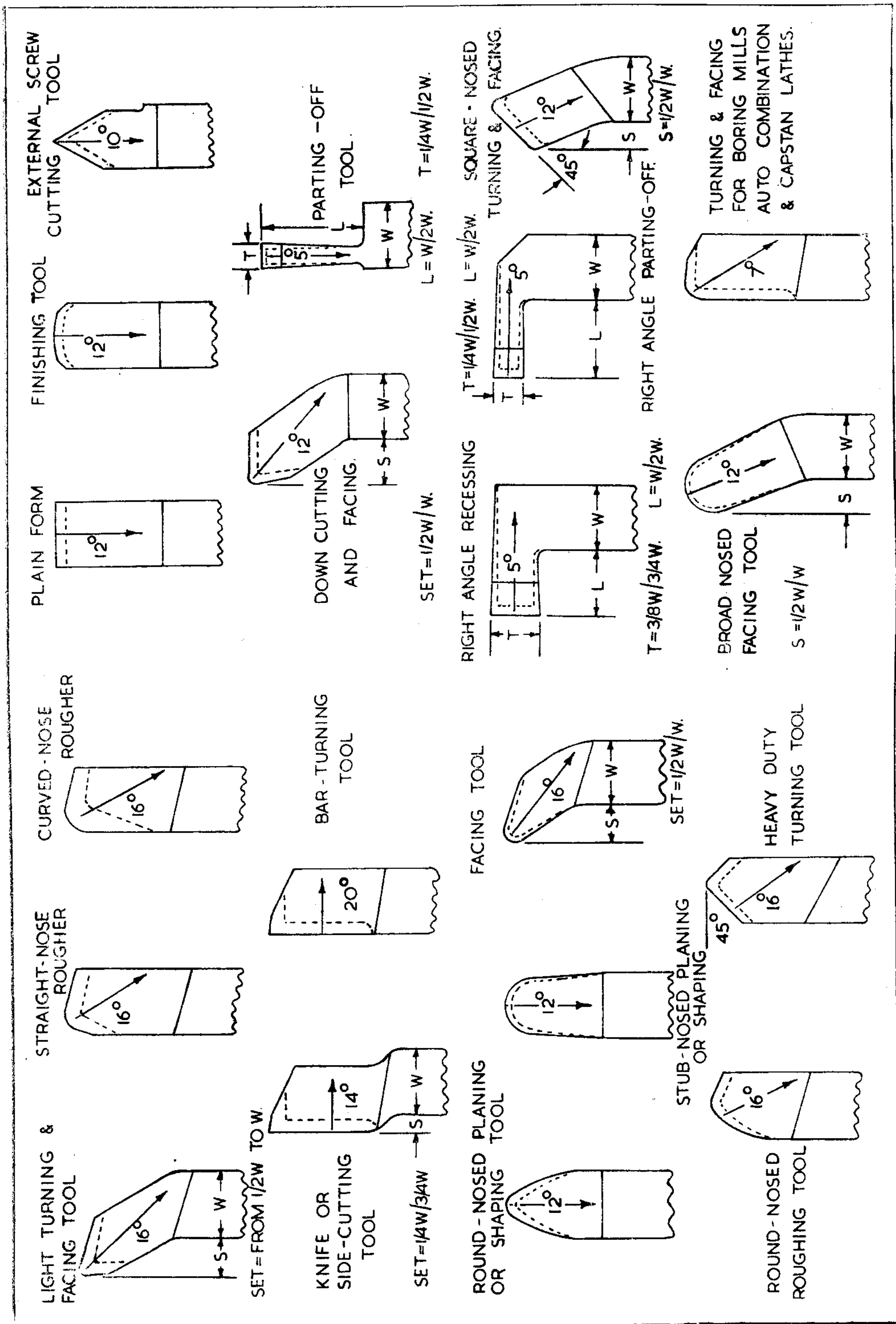
Included plan angle is the included angle between the front cutting edge (or trail edge) and the side cutting edge measured in a plane parallel to the base.

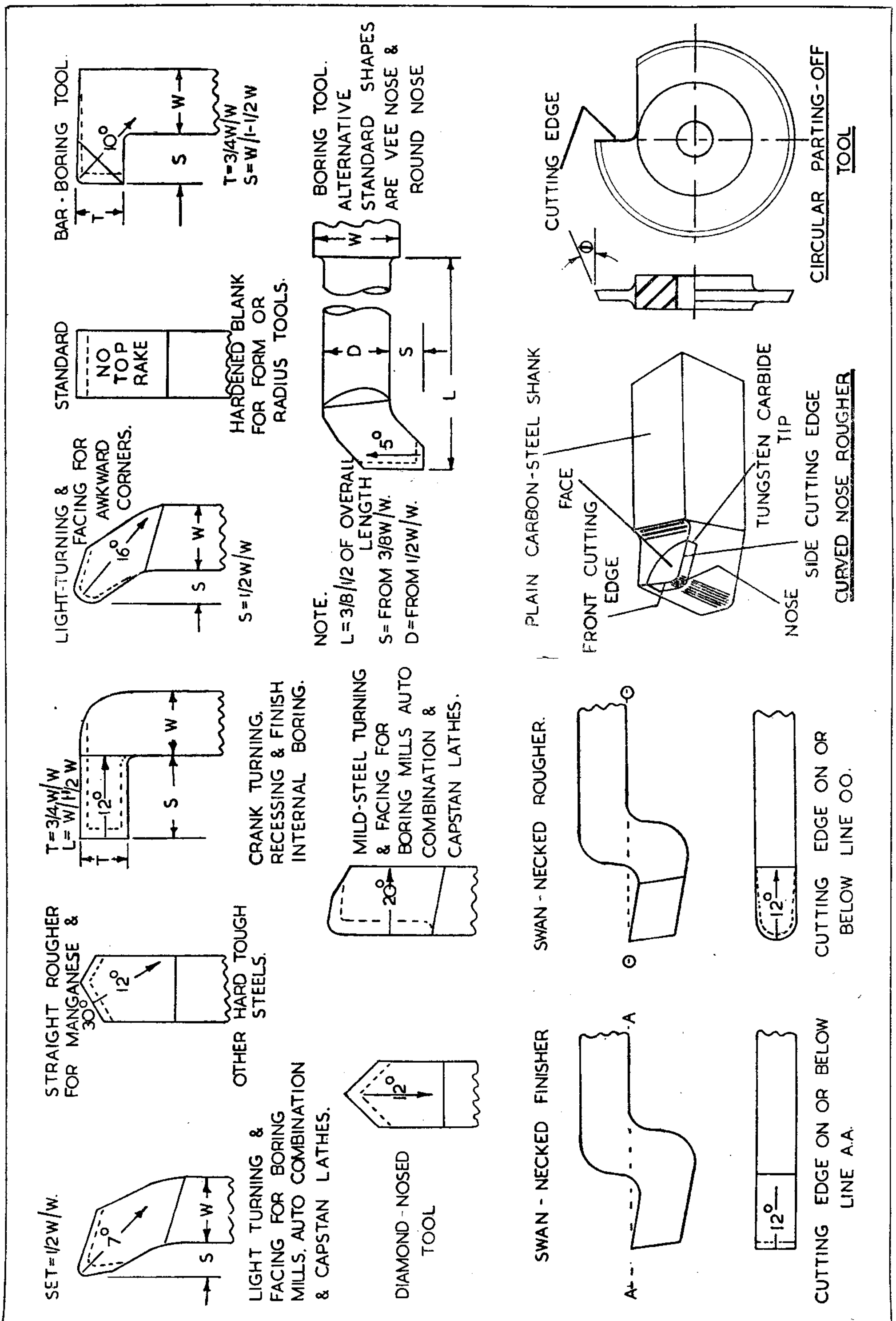
Secondary clearance angle. This is the angle between a line at right-angles to the base and that portion of the flank situated below the clearance angle measured at right-angles to the cutting edge. The life of a grinding wheel can be increased by the use of secondary clearances under the tip to allow for the grinding of the tip only and not the shank material, which would quickly clog the wheel grinding gauges and templates. To ensure that rakes and angles are maintained will be found advantageous.

Clearance angles are bound up with the height at which the tool is set. The figures shown in the drawing are for the cutting edge being set centrally. It is defined as the angle between a line at right-angles to the base and that portion of the flank immediately below any cutting edge or other face edge measured at right-angles to the edge. Clearance angles are associated with their respective edges, e.g., side cutting edge clearance angle, front cutting edge clearance angle, nose cutting edge clearance angle.

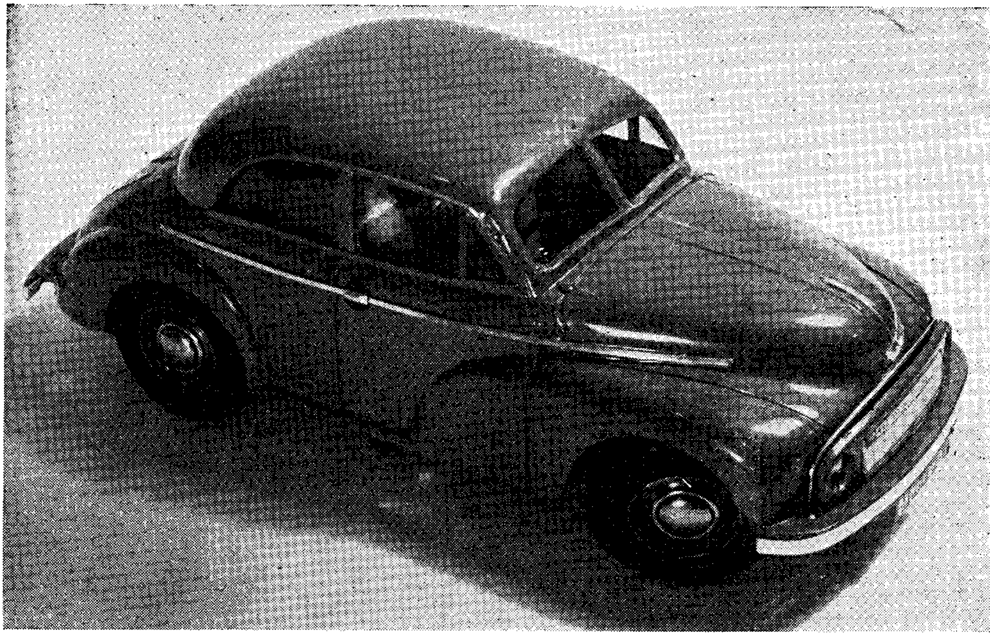
Maximum rake plan angle is the angle between a line parallel to the side of the shank and the direction of maximum rake, measured in a plane parallel to the base.

(*Continued on page* 19)


LIGHT TURNING & FACING TOOL
SET=FROM 1/2W TO W.
KNIFE OR SIDE-CUTTING TOOL
SET=1/4W/3/4W
ROUND-NOSED PLANING OR SHAPING TOOL
ROUND-NOSED ROUGHING TOOL
STRAIGHT-NOSE ROUGHER
STUB-NOSED PLANING OR SHAPING
CURVED-NOSE ROUGHER
BAR-TURNING TOOL
FACING TOOL
SET=1/2W/W.
HEAVY DUTY TURNING TOOL
PLAIN FORM
DOWN CUTTING AND FACING.
SET=1/2W/W.
RIGHT ANGLE RECESSING
T=3/8W/3/4W.
L=W/2W.
BROAD NOSED FACING TOOL
S=1/2W/W
FINISHING TOOL
PARTING-OFF TOOL
L=W/2W.
T=1/4W/1/2W.
T=1/4W/1/2W.
L=W/2W.
RIGHT ANGLE PARTING-OFF
EXTERNAL SCREW CUTTING TOOL
SQUARE-NOSED TURNING & FACING.
S=1/2W/W.
TURNING & FACING FOR BORING MILLS AUTO COMBINATION & CAPSTAN LATHES.


SET = 1/2 W/W.
LIGHT TURNING & FACING FOR BORING MILLS, AUTO COMBINATION & CAPSTAN LATHES.
STRAIGHT ROUGHER FOR MANGANESE & OTHER HARD TOUGH STEELS.
T = 3/4 W/W
L = W/1 1/2 W
CRANK TURNING, RECESSING & FINISH INTERNAL BORING.
LIGHT-TURNING & FACING FOR AWKWARD CORNERS.
S = 1/2 W/W
STANDARD
NO TOP RAKE
HARDENED BLANK FOR FORM OR RADIUS TOOLS.
BAR - BORING TOOL.
T = 3/4 W/W
S = W/1-1/2 W
DIAMOND - NOSED TOOL
MILD-STEEL TURNING & FACING FOR BORING MILLS AUTO COMBINATION & CAPSTAN LATHES.
NOTE.
L = 3/8/1/2 OF OVERALL LENGTH
S = FROM 3/8 W/W.
D = FROM 1/2 W/W.
BORING TOOL. ALTERNATIVE STANDARD SHAPES ARE VEE NOSE & ROUND NOSE
SWAN - NECKED FINISHER
SWAN - NECKED ROUGHER.
PLAIN CARBON-STEEL SHANK
FACE
FRONT CUTTING EDGE
TUNGSTEN CARBIDE TIP
SIDE CUTTING EDGE
NOSE
CURVED NOSE ROUGHER
CUTTING EDGE
CIRCULAR PARTING-OFF TOOL
CUTTING EDGE ON OR BELOW LINE A.A.
CUTTING EDGE ON OR BELOW LINE OO.

A Model Morris



WE recently received from Messrs. Forsselius Ltd., Blossom Street, York, a handsome little replica of the Morris Minor, 1/18th full size, produced by Victory Industries (Surrey) Ltd.

The model is powered by the well-known Victory "Mighty Midget" electric motor, which will run for considerable periods on a small, flat torch battery. As can be seen from the photograph, a very good scale appearance is enhanced by the die-cast detachable wheels and press-on discs, and the plastic material from which the body is formed ensures an excellent finish in any of the standard colours of the full-size car. The retail price is £1 19s. 9d., complete (less battery) in a replica of the type of packing case used by the export division of the Nuffield organisation.

Messrs. Forsselius Ltd. are the concessionaires for Great Britain and Northern Ireland.

TOOLS AND TOOL ANGLES

(*Continued from page* 16)

Rake angles. These, when large, give a keen cutting angle with the tendency to cause chips to curl close to the cutting edge. They are positive if the face slopes downwards from either side or front cutting edge or other face edge, and negative if the face slopes upwards. An alternative method of measuring top rake is by measurement of the maximum rake.

Front top rake (cutting edge back rake) is the angle between the base and the face measured in a plane parallel to the plan approach angle.

Side top rake (cutting edge side rake) is the angle between the base and the face, measured in a plane at right-angles to the plan approach angle.

Maximum rake is the maximum angle between the base and the face measured in a plane perpendicular to the base. The angle is positive if the face slopes downwards from the cutting edge, and negative if the face slopes upwards

Angles on Lathe Tools.

Material cutting	Front top rake	Side top rake	Clearance
Soft Steel ..	8°	20°	6°
Medium Hard Steel	8°	18°	6°
Hard Steel ..	8°	14°	6°
Cast-Iron ..	8°	14°	6°
Brass	0°	0°	6°
Hard Gun Metal	3°	8°	3°
Chilled Iron ..	3°	8°	3°
Aluminium ..	20°/25°	15°/20°	8°/10°

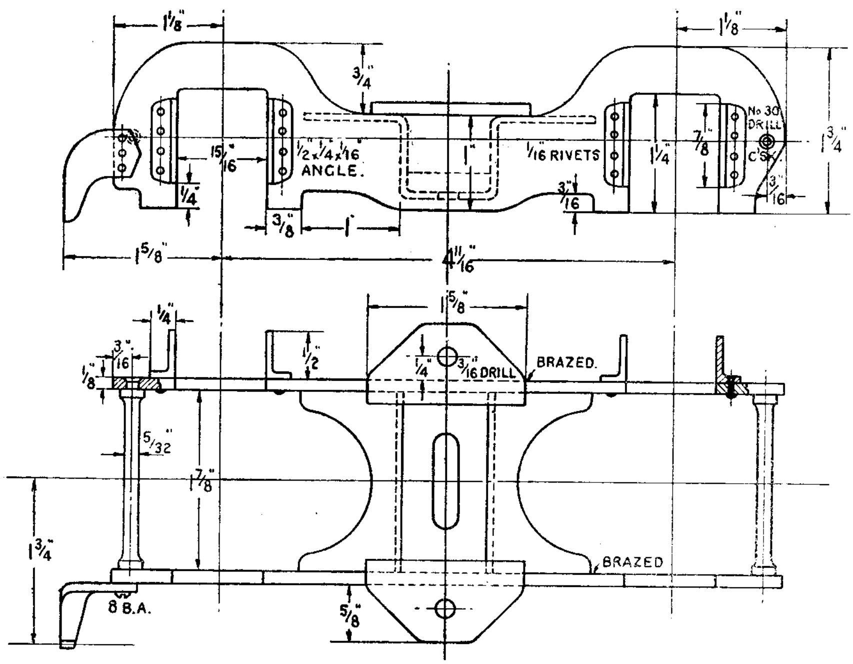
(*Table by courtesy : Firth Brown Tools Ltd.*)

"Britannia" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

THE bogie for this engine is different to any I have previously described, inasmuch as it is a simplified edition of the full-sized article as far as components are concerned, whilst the construction calls for brazed instead of riveted bearings in the bogie, and I shall also fit them to the tender axleboxes, as a kind friend in U.S.A. sent me a dozen ; dinky little things like miniature roller bearings, and they make a nobby job.

A sliding block fits in the channel-shaped



Bogie frame details and plan of assembly

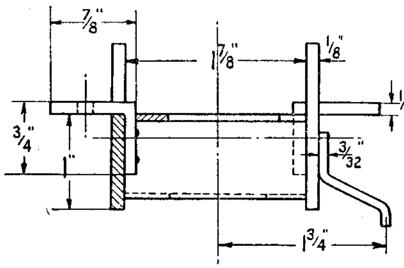
joints between side frames, centre, and bolster brackets. I found the job quite simple and straightforward, and there is no reason why builders shouldn't do the same. Whilst it is quite possible to use a casting for the middle part, combining both the centre-piece and the bolster brackets, bent sheet metal may be used. The centre-piece is just like one of my tender-pump stands erected upside down ; and pieces of heavy angle could be used for the brackets, as shown in the illustrations. In the finished job, there is an equaliser each side, consisting of two plates cut to the usual shape, with a hefty leaf spring between, the hoop or buckle of which is furnished with a projection that fits in the hole in the bracket. The spring is what the kiddies would call "upside down," and the ends are connected to the equaliser by links. At each end of the equaliser beam is a small block with a rounded end, which sits in a depression in the top of the axlebox. The latter may have either ball or plain bearings, just as you fancy ; I'll give details of both. My own engine has Torrington needle centre-piece of the bogie, and this is drilled to take the ordinary round bogie pin, which projects from the underside, and goes through the slot at the bottom of the channel, where it is provided with the usual nut and washer. A rubbing-plate is inserted between the top of the sliding block, and the bogie bolster. As the front of the engine will be mighty heavy—some good folk may faint with shock when they see the cylinder castings, with the Bill Massive piston-valves !—the friction between the bolster, rubbing-plate, and sliding block will prevent any tendency to shoulder or oscillate ; but controlling springs may be added if desired, merely by drilling recesses in the sliding block for them. However, I shouldn't advise them for curves of less than 30 ft. radius.

Frame Plates and Centre Piece

The side plates are cut from $\frac{1}{8}$-in. mild-steel, bright or blue, doesn't matter which, as long as it is flat. All dimensions are given in the illustration, and as the job is similar to cutting out engine frames, you won't need any detailing. A No. 30

hole is drilled at each end, and countersunk, to accommodate the ends of the tie bars ; these holes can be used for riveting the plates together whilst cutting out. Use a bit of bar $\frac{15}{16}$ in. wide, as a gauge for testing the axlebox openings ; the fit need not be as exact as for the coupled axleboxes, but don't have it too slack.

In the notes describing the hand pump for *Tich*, I described and illustrated a simple way of bending up the channel-shaped stand, so as to get a correctly-shaped-and-dimensioned job. Well, the centre-piece of *Britannia's* bogie can be made by exactly the same method. Kick off with a piece of soft 16-gauge steel plate $1\frac{7}{8}$ in. wide (see that both edges are parallel) and a little



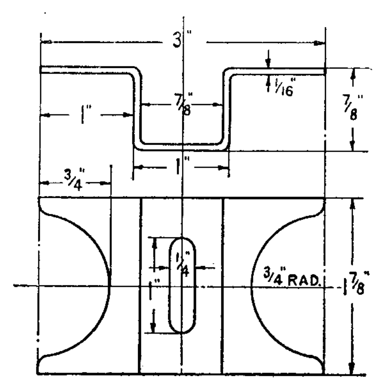
How to erect bolster-brackets and guard-irons

over 5 in. long. Bend the channel first, and then cut the ends to suit it. The semi-circular cutaway parts can then be tackled, and carried out just the same as the recesses in the main frames above the bogie wheels. Drill a $\frac{1}{4}$-in. hole at the position shown at each end of the slot for the bogie pin, and another in the middle ; finish removing the surplus metal with round and flat files.

Brackets and Tie Rods

On my own engine, I made the two brackets from a piece of $\frac{3}{4}$ in. $\times$ $\frac{7}{8}$ in. $\times$ $\frac{1}{8}$ in. steel angle which I happened to have handy. Two pieces were cut to a length of $1\frac{5}{8}$ in. full, and then the $\frac{7}{8}$ in. part was sawn and filed to the shape shown in the plan. Did I hear somebody ask if the milling machine had broken down ? Bless your hearts and souls, it doesn't follow that because I have a powerful milling machine—powerful, that is, for a home workshop—that I do every small job on it. It was far less trouble to grip the two bits of angle in the bench vice, saw the corners off, and trim them with a file and a little elbow grease, than to set up the job on the machine. Maybe I'm getting lazy in my old age, but I always take the easiest and quickest way. Well, another application of the saw and file reduced each $\frac{3}{4}$ in. part to a width that just fitted nicely in the channel, and that completed the two brackets to my satisfaction.

The tie-rods were turned from $\frac{1}{4}$-in. round mild-steel. As a matter of fact, they needn't have been turned at all ; a plain $\frac{1}{4}$-in. rod shouldered down at each end, would serve the purpose just as well. However, the big engines have turned rods, and I agree with our old friend Inspector Meticulous in some things, so I turned the tie-rods on my little engine, and they look swell. In passing, some of the followers of these notes are schoolmasters, and one of them called me over the coals for using expressions like that—well, did you ever ! There I go again !—and said I didn't write perfect English. Of course I don't ; I just love to jolly well split infinitives, and ending a sentence with a preposition is one of the best ways I know of. *And* it tickles me no end to start one with a conjunction But (there's another one) let's get back to the job. The correct way to turn the tie-rods, is to centre the piece of round steel, drill centre-holes at each end with a centre-drill, and turn it between centres ; but there is too much " centralisation " about that job for your humble servant. What I did, was to put a bit of $\frac{1}{4}$-in. round mild-steel in the three-jaw, turn a $\frac{1}{8}$-in. pip on the end of it about $\frac{3}{16}$ in. long, and then pull it out of the chuck jaws so that about $2\frac{1}{2}$ in. length was projecting. I keep a few short bits of rod with various sizes of holes in the end. One of these, with a $\frac{1}{8}$-in. hole in it, was put in the tailstock chuck, and the tailstock run along the lathe bed until the pip on the embryo tie-rod entered the hole in the brass rod, which then acted as a bearing and steady combined. A round-nosed tool reduced the centre part of the tie-rod to size, in two wags of a dog's tail ; it was parted off at $2\frac{1}{16}$ in. from the shoulder, reversed in the chuck, and the other $\frac{3}{16}$-in. pip turned, leaving a correctly-shaped tie-rod $1\frac{7}{8}$ in. between shoulders. The whole job was done in little longer than it takes me to write the description ; if I didn't get a move on when working, I'd never get anything done at all. I only wish I could draw and write as quickly—life would be a bit easier !



Bogie centre

How to Assemble the Parts

Put the pips on the ends of the tie-rods through the holes in the ends of the bogie frames, and rivet them well down into the countersinks ; don't bother to file them flush yet. If the holes in the frames were drilled truly, and the tie rods properly turned with square shoulders, the two frames should be parallel in every way, and dead in line, as my own were. One of the brackets was then placed in position, exactly halfway along the bogie frame ; the top part should rest on top of the frame, as shown in both the side and end views. Rivet this in place with four $\frac{1}{16}$-in. rivets. Now put the centre-piece tem-

porarily in position between the frames, with the channel going over the riveted-on part of the bracket; then put the other bracket in position. You can't go wrong with this, as the lower part of the brackets can only go in the channel, and the two brackets must then of necessity be in line. Remove centre-piece, rivet the bracket in place, same as the first one, and then replace the centre-piece, carefully adjusting it to the position shown in the drawing. It should be level with the top of the cut-away centre part of the bogie frames, and $\frac{1}{8}$ in. from the bottom; see side and end views.

On my own bogie, the centre-piece was a tight jam fit between the two side frames, after the tie rods had been fitted; and all I had to do, after adjusting the centre-piece to correct position, was to anoint the joints all around, where the centre-piece touched the frames, and around the edges of the brackets with some wet flux, and get busy with my blowpipe. I used 150-litre tip, a piece of $\frac{1}{16}$-in. Sifbronze welding wire, and the job was just a piece of cake (I hope that schoolmaster gets a big kick out of reading this, even if he doesn't build *Britannia*), easier than soft-soldering. My pet "technique" is to run the flame around the whole joint until the moisture dries out of the flux, and leaves it sticking to the joint. Then I concentrate on one end of the joint until it glows red, apply the Sifbronze wire, and gradually work along, feeding more of the welding wire into the redhot spot under the moving flame. This gives a regular fillet, just the same as you'd get with soft-tommy applied with a soldering-bit. Only steel joints can be done this way; with copper, the drop-by-drop method, giving a rippled finish, must be used, because the copper conducts the heat away so quickly that it is next to impossible to get a regular fillet.

As most builders of *Britannia* will be using either a blowlamp or an air-gas blowpipe—oxy-acetylene sets are the exception, rather than the rule, in home workshops, but they really do save labour and perspiration; I wouldn't be without my old Alda for all the tea in China—the above method cannot be used, and ordinary brazing must be substituted. The ultimate result should be just as good, if the merchant holding the heating apparatus is the lad I take him to be; but there is just one wasp in the jampot. The diffused flame of the blowlamp or air-gas blowpipe will heat up the whole side frame of the bogie, and most of the centre-piece as well, and I don't have to remind you that when metal gets hot, it expands. The expansion in the present instance would be sufficient to allow the centre-piece to fall out, or at least shift its position, unless some means of retaining it is provided. The simplest gadget for the job would be a small G-cramp, of the kind used by carpenters; if this were placed outside the frame, and tightened well up—though not sufficient to cause distortion when the frames become red hot — it would keep the frames squeezed tightly against the centre-piece, and there would be no fear of shifting. A fairly stout bit of steel bar, outside each frame, with connecting bolts at each end, would also do the trick. As to the job itself, just apply wet flux (Boron compo) blow to bright red, and apply some easy-running brazing strip; or if you are in the super-income-tax class, coarse grade silver-solder could be used, which melts at dull red. Inexperienced workers shouldn't forget that steel jobs are quenched in water only, not acid pickle. Any burnt flux can be knocked off with an old half-round file with the tip broken off; and the whole doings should then be cleaned up with emery-cloth, the ends of the tie-rods, where riveted over, being filed flush.

Horncheeks and Guard Irons

The horncheeks are merely $\frac{7}{8}$ in. lengths of $\frac{1}{2}$ in. × $\frac{1}{4}$ in. × $\frac{1}{16}$ in. angle. If the unequal angle is not readily available, bend it yourself. It is easily done, from 16-gauge sheet brass, in the bench vice; bend each bit separately. Then file the ends as shown, and rivet the pieces in place with $\frac{1}{16}$-in. rivets, countersunk in the angles. Use steel or iron rivets, as they hold tighter than copper rivets. The guard-irons can be cut and bent up from 3/32-in. sheet steel, to the shape shown, and attached to the front ends of the frames by 8-B.A. round-head screws. Both the above jobs are too simple to need detailing. The above construction makes an immensely strong job; I might add that the bogie for my own *Britannia* is the strongest I have ever built, and that is saying something!

The Proof of the Pudding Again!

Without wishing to unduly "rub it in," I would recommend all those good folk who adversely criticised *Britannia* and her sisters, to look up their exploits in "full-size" journals, and they will get a few surprises. Not only that—the valve gear and valve setting on these engines is the nearest thing yet, in full size, to the arrangements I always advocate, and use, on little engines. For example, 62½ miles per hour up Tring bank, with fourteen coaches, *on half the coal consumption of a spam can* (VERY important that!!) is something that Mr. Riddles and his merry men are entitled to shout about. The 11-in. valves have $\frac{1}{4}$ in. lead; this setting was found, on the test stand at Rugby, to give the best results, just as your humble servant always said it would; what have the "negative leaders" to say to that? The bald, stark, and incontrovertible fact is, that for acceleration, speed, and sustained power, you have just got to get the full steam pressure on the piston-head *at the exact instant that the crank passes the dead centre*; and the only way to do that, is to open the port *before* the piston reaches the dead centre. "Negative lead"—positive poppycock! Everything in this benighted world takes *time*; and if the ignition spark of an i.c. engine has to be advanced, so that the piston gets the full benefit of the explosion as the crank passes top dead centre, how much more necessary it is to admit the steam, snail-like in its movement as compared to the explosion, plenty early enough to arrive at the job "on time"? No amount of bigoted and obstinate argument can alter what has now been definitely proved, both on the Rugby test plant, and in actual service. Nuff sed!

Talking about coal consumption, Angus McCurly is tellin' ye, dinna ye greet a Scottish driver or fireman wi' "Lang may your lum reek." Verra bad combustion, ye ken!

Novices' Corner

Making Small Boring Tools

SMALL boring tools, forged from a single piece of steel, have the disadvantage that the slender shank must be made long enough to enable the cutting point to reach to the bottom of the deepest hole likely to be encountered; this means that, in the smallest sizes, these tools are apt to spring and so may give rise to inaccurate machining. If, however, the tool is made in two parts, so that the tool itself can slide in a holder, the overhang can be reduced to the minimum necessary to machine to the end of the bore, and tip should appear as shown in the accompanying Fig. 3B. There is no need, at this stage, to file the tip exactly to the angles specified, for the cutting edges will later be accurately finished by grinding with the aid of an angular rest. But before the tip is ground, the tool must be hardened and tempered in the manner previously described in these notes; furthermore, grinding is best postponed until the tool can be more easily held at the correct angle by being mounted in its own holder.

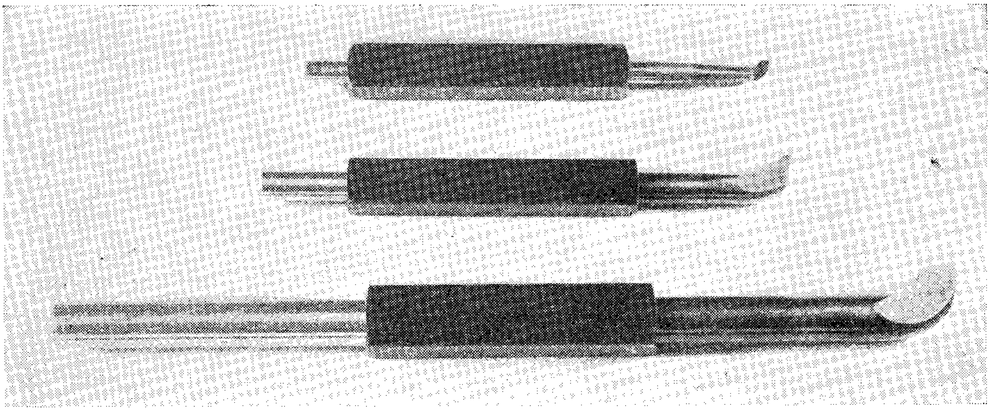


Fig. 1. Three sizes of small boring tools

the maximum degree of rigidity will then be obtained. The boring tools illustrated have this form of construction; that is to say, the tool itself, or cutter bar, is made from a length of round silver-steel, and the holder is machined from a piece of square bar. As this holder is split on one side, the complete tool will be securely held when clamped in the lathe toolpost.

The Cutter Bar

The first operation is to bend one end of the rod to form a right-angle. For this purpose, the steel is slowly and evenly heated to a cherry red, so that when the rod is gripped in the vice or hammered on an anvil, it can easily be set to shape.

Nevertheless, working the metal after it has cooled must be avoided, or cracks may form and the tool will then break when put into use. Next, after the end of the rod has been cut off to the required length with a hacksaw, the tip is formed with a file to the shape shown in Fig. 2. When filing the clearance below the cutting edge, the tool should be tried against a drill gauge by selecting the hole corresponding to the smallest bore the tool is required to machine; this method is illustrated in Fig. 3A, and the finished

Making the Tool Holder

As these tools will generally be held in place on the lathe top-slide by means of the toolpost clamp-plate, the holder is accordingly made $2\frac{1}{4}$ in. in length in all sizes.

For tools with shanks up to $\frac{1}{4}$ in. in diameter, the holder is machined from $\frac{3}{8}$ in. square mild-steel, but larger tools will require a square holder of $\frac{1}{2}$ in. diameter or more. After the material has been cut to length, the square bar is mounted to run truly in the four-jaw chuck by using the dial test indicator mounted either on the lathe bed or in the toolpost. If the square material is accurately formed, the easiest way of centring the work is to apply the test indicator to each corner in turn, and to adjust the chuck setting until a uniform reading is obtained.

Where the centring is carried out with reference to flat faces of the bar, the indicator should be mounted at exactly lathe centre height, and the lowest reading of the indicator is taken on each face as the mandrel is rocked to and fro. Other ways of setting the work to take readings with the indicator are: by bringing a try-square, resting on the lathe bed, against each face in turn: by using a distance-piece to locate the four chuck jaws from the lathe bed: or by indexing the man-

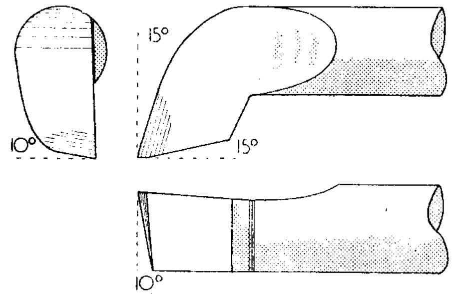


Fig. 2. *Showing the form of the tool tip*

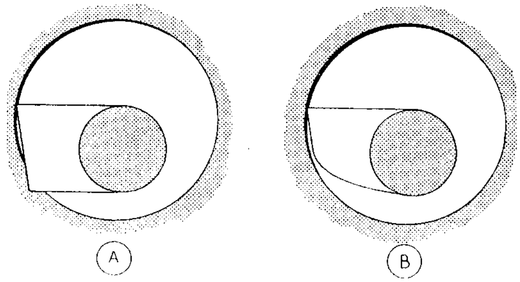


Fig. 3. *Forming the working clearance*

drel setting with some simple form of dividing gear. When the work has been set truly in the chuck, the end of the bar is faced with a knife tool. Next, a centre drill is entered in the work and, if a $\frac{1}{8}$ in. diameter centre drill is fed in for some distance, the $\frac{1}{8}$ in. diameter pilot drill that follows will automatically be given a true start. For drilling quickly and accurately right through the bar, this pilot drill should be run at the highest mandrel speed, but the drill must be withdrawn at frequent intervals to clear the accumulated chips from the flutes and, at the same time, to give a fresh supply of cutting oil. The small pilot drill is best followed by a $\frac{1}{4}$ in. diameter drill when machining the holder to take a $\frac{3}{8}$ in. diameter tool. Finally, the work is drilled with a reaming-size drill, but only a very small amount of metal should be left for the reamer to remove, otherwise bell-mouthing of the bore may result. After the bore has been reamed to size, a cut is made with a hacksaw through one side face of the holder, as shown in Fig. 4 ; this is, of course, to allow the holder to contract and grip the tool when clamped in position.

It will be found easier to keep the saw cut straight if the work is first accurately marked-out with two parallel lines to indicate the path of the saw blade. Where the bore for the tool is small as compared with the diameter of the holder, the saw cut may be continued for a short distance into the opposite side, in order to allow the holder to close more easily on the tool.

Finally, to finish the cutting edges, the tool is placed in its holder and a toolmaker's clamp is applied to the holder to secure the tool in place. This will enable the tool to be more easily handled for accurately grinding the cutting edges, with the aid of the angular grinding-rest set to the appropriate angles. As represented in Fig. 5, when mounting the tool in the lathe, the toolpost clamp-plate must be set so that it bears on the holder along the edge immediately over the slit formed in the side face of the bar.

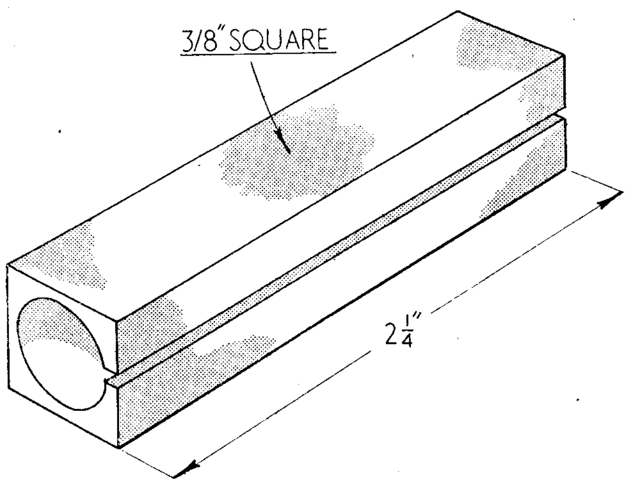


Fig. 4. *The tool holder*

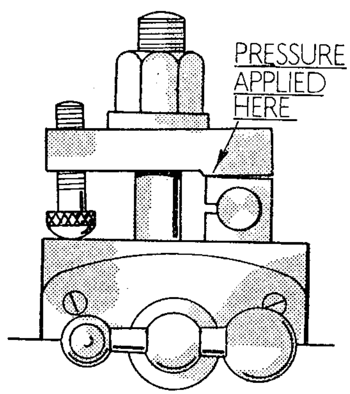


Fig. 5. *Method of clamping the tool in the lathe*

*TWIN SISTERS

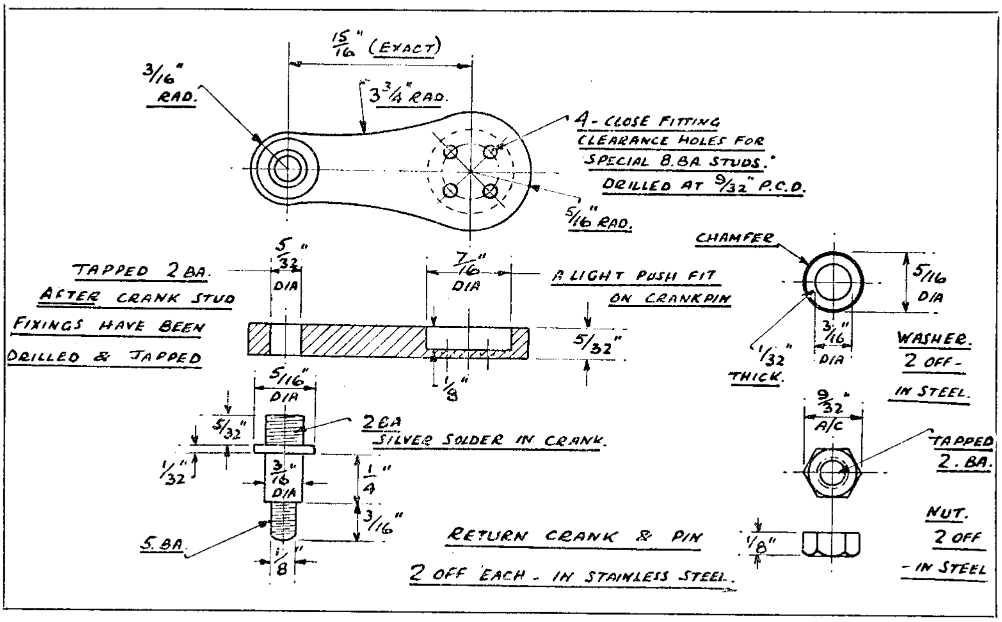
by J. I. Austen-Walton

Two 5-in. gauge locomotives, exactly alike externally but very different internally

WHEN the two remaining parts of the motion work, now to be described, are completed, there will be nothing to prevent your making a preliminary air or steam test—that is, if you care to set up some temporary steam connections between the cylinders.

Normally, I would go on with the lifting links and cross-shaft, followed by the reach-rod and running ; there simply is *not* any compromise on this point for any reasons whatsoever ; so do not be misled into believing otherwise. It is generally understood that the crank setting must be at 90 deg. to the main crank in order to give equality to both directions of running, and as a theoretical statement, this is correct.

There is, however, a snag—the snag being one



pole reverse, and which I may still slip in before turning to pipework. The pole reverse, by the way, will give the real enthusiasts a chance to turn out a really top-notch piece of work, and I am setting out this item with very careful regard to the original article. I do want the cab fittings and steam valves and pipes to look as though they were made by a locomotive man, and not a plumber ; at the same time, these fittings must be more than ornaments, and be capable of giving long and satisfactory service. But more of this later.

Return Cranks

Just to be brutally obvious for a moment, I am going to remind readers that the return crank is the outside eccentric of the valve-gear. With Walschaerts' valve-gear, the position of the return crank or eccentric is *fixed* for constant valve events for both forward and backward

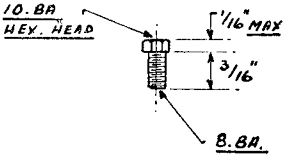
**Continued from page* 811, " *M.E.*," *Vol.* 104, *June* 21, 1951.

of geometrical origin, and often overlooked. Where the tail link swings on the *same* centre-line as the cylinder, and, therefore, the wheels and axles in their correctly loaded position, the angle of setting will be 90 deg. But the tail link eye swings in an arc, and not through a fixed and straight line, and, therefore, we have to take a mean line, based on a midway position between highest and lowest positions relative to the true horizontal. Therefore, with a gear that tends to work on a higher level than the cylinder centre-line—and most of them do—there will be a tendency for the 90-deg. angle to be altered to suit the case.

The main thing, in our case particularly, is to ensure that the fitting or fixing of the return crank is made in its only possible position—the *correct* position. I do not believe in making the return crank movable, with the sole idea of being able to smooth out or cheat some mistake somewhere else in the valve setting. I have, therefore, devised a return crank setting jig which will take care of all the geometric problems

for you, provided, of course, that you make the jig *exactly* to the dimensions given, and use it *exactly* as directed. The greatest advantage of the positively fixed return crank lies in its all-time certainty, with the added advantage that it can be removed for cleaning or service without fears concerning lost settings. I have just the same feeling about inside eccentrics, and would go to infinite trouble to find correct settings and, having at last found them, by my method, guaranteed them for all time ; so how about making some return cranks ?

RETURN CRANK STUDS 8 - OFF. IN HIGH TENSILE OR STAINLESS STEEL.



The profiling out of the cranks from a piece of steel of the thickness given, will bother nobody, and careful note should be made of the need to leave the crankpin eye untapped. But before drilling this hole, I deem it advisable to mount the blank in the four-jaw chuck of the lathe, in order to bore out the back cavity that embraces the extended end of the main crankpin. Take special care to get a good fit here—a gentle push fit being the most desirable, as this will not bias the setting of the crankjig later on.

Having got the bore just right, set out and drill the crank-pin hole. You can choose whatever method you like for this, remembering that the throw of the crank will have a definite bearing on the successful working of the engine, so try to get it right within reasonable limits.

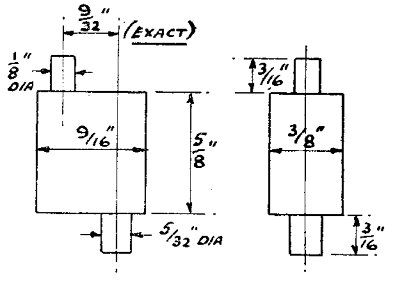
As a rule, when I make this type of return crank, I do the whole job on a rotary turntable, which enables me to put in not only the group of four holes but the crankpin hole as well — all in one direct setting. For those who are interested, here is the method. Set up on the milling table a true running peg, on to which the cavity in the back of the return crank will press lightly. Pack up the extended portion of the crank to true level, and arrange light cramps on either side—about half way down, leaving surfaces to be drilled, clear and unobstructed. If the holding peg has first been centred truly, and carries a correct " Slocombe " centre, it will be easy to insert a lathe centre in the vertical milling head to pick this up, and from which operation, the travel positions of the slides (after backlash has been taken up) can be noted from the numbers on the feed thimbles. Now wind away to the required throw of the crank, and turn the table until the correct radial position is found, noting the number of degrees on the table, or preferably, making it zero.

A centring drill in the machine head will now do its work, after which a full drilling can be carried out *in situ* ; this is not absolutely necessary, as a good, clean centring will usually stay true for such a short drilling.

Now wind back to the original or true centre, and wind out again to the pitch radius of the four-hole group and then turn the turntable 45 deg. Once more a centring drill will do its work, followed by a 90 deg. turn of the table, and repeat of centring, and so on again, continuing with the 90 deg. of turn for the remaining two holes. As a result of all this twisting and turning, you get two return cranks with perfectly true throws, and perfectly symmetrical and truly disposed groups of fixing holes ; and the job takes only a few minutes to complete. When all the drilling has been done, the parts can be cleaned up and the front faces and edges can be rounded over slightly to emulate the general appearance of a steel forging.

In case you do not quite recognise this particular look, I suggest the following : With a small and fairly fine and half-round file, work over the edge of the crank, starting from the full radius of the crankpin eye (which should be left sharp) and running right round the fitting without a break to the same place on the other side. Make the rounding a little under a $\frac{1}{16}$ in. radius, and blend it off well, especially at the starting and leaving-off points, where it should fade away gently. By all means, take the extreme sharpness off the back edges, but do not let this amount to a definite radius.

And so you think I'm a bit fussy about my blessed old return cranks, do you ? Well, let me remind you that, apart from judges, more people have a good look at return cranks than at any other part, and on the move they exercise a greater degree of fascination than almost any other moving part—see ?



RETURN CRANK FIXING JIG
1 OFF - IN STEEL.

Return Crank Fixing Jig

There is only one thing to watch when making up this little gadget—getting the two centres right. If you can rely on your four-jaw chuck holding work truly, I suggest you use it for the job. A $\frac{5}{8}$ in. long hole should not be too difficult a proposition to drill truly, and if you can rely on this going to plan, you could mark out both holes from one end, picking them up individually by means of a " sticky pin," and drilling them press fit sizes for the two diameters given ; small pieces of standard silver-steel would do for the pins.

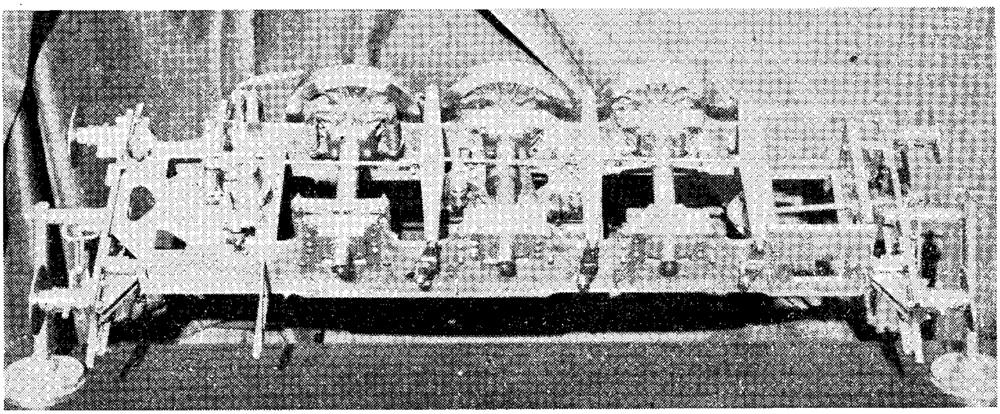
Another quite simple way of getting the centres

right would be to hold the block in a machine vice on a lathe slide, afterwards clamping this to the drilling machine table, when the travel could be calculated in terms of handle turns, and each position dealt with *via* centring drill and final drill.

To use the jig, note the position of the return crank relative to the main crank, there being two *possible* positions and only one being right. Being a slide-valve engine, the return crank leads in the direction of normal forward travel; by looking at the left-hand side of the engine, and forgot that—short of the pukka lard oil, wait until Mrs. is out, and then take a blob of household lard or cooking fat—excellent stuff for stainless.

Eccentric-rods

These, in the main are a simple and straightforward job, with "Minor" builders excused the taper flute, and the extra lug under the big-end. But before making up the rods, let us take stock before actually adding the "missing link" to complete the picture.



The chassis of Mr. A. A. Smith's "Major"

with the main crank down at bottom dead centre, the return crank would lean towards the *back* of the engine.

Now, take the jig, and press the $\frac{1}{8}$ in. diameter peg into the hole drilled in the axle centre; now thread the untapped eye of the return crank over the outside peg, at the same time engaging it with the main crankpin, and checking that it leads as directed above. Lay the engine on its side, and with a portable hand drill, start holes in the end of the crankpin, using the return crank itself as a sort of temporary jig. Once you have secured sufficiently deep starting holes in the crankpin, you can remove return crank and jig (have you marked the return crank for reference?) and continue drilling to the full depth. These holes have to be tapped, and I know what most people feel about tapping blind holes in stainless steel; but how many people realise that there are special allowances in the matter of drilling sizes for this material? As a a general guide, select a drill a few thousandths above the size given on the normal chart—say, about three-thou. and drill the hole a good $\frac{1}{8}$ in. deeper than required. Use a good, sharp tap or taps, and above all—*take your time*, it doesn't really matter if these holes take the whole of one evening; it will be much better than worrying about the removal of the stump of a broken tap left in the very last hole. As I say, with sharp and graded taps, frequent removal for clearing swarf, and plenty of unhurried care should see you through without the slightest difficulty. Lubricant for stainless steel? Oh, yes, I nearly

As far as we have got, there should not be any places where errors, likely to upset valve setting, could creep in. We have in fact, only one variable which is provided in the form of a valve spindle adjustment, and which it is right and reasonable to include.

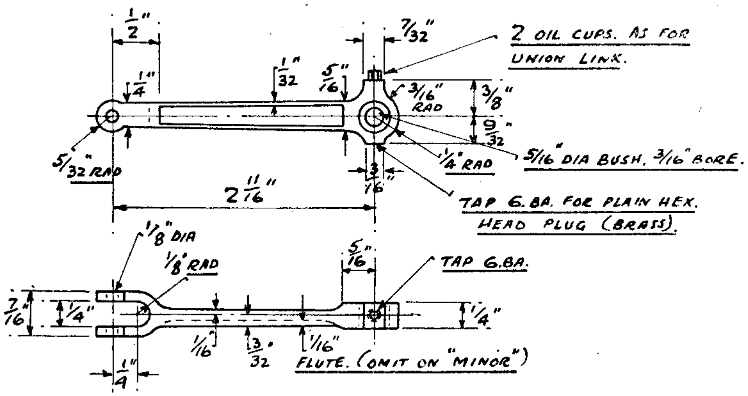
That leaves us with two danger spots, the first being the return crank which we have so set as to preclude the possibility of a number of slight errors being built up into a state of just becoming workably possible—an unfortunate thought, anyhow.

Secondly, the positioning of the motion-plate and the expansion link and its bearings, with the possibility of some builders' errors in the up-and-down or back-and-forth positions. Of the latter, only the length of the eccentric-rod will be affected, and any difference from the prescribed length can readily be discovered now.

Of the former, most of any possible error will be taken up in the valve spindle adjustment, whilst any remaining factor becomes a fairly minute error of angularity which can be compensated almost entirely in the remaining scapegoat, the eccentric-rod.

For this reason, I wholeheartedly recommend the making up of a makeshift and extendable rod with which to try out the engine, and from its ultimate and proved centres the final rod can be made.

This temporary rod should be of fairly stiff section, and made in two halves, slotted and bolted together, side by side to allow greater or lesser



ECCENTRIC-ROD. 2 OFF (HANDED) IN STAINLESS STEEL.

length than the theoretical dimension given. As you may want to run the engine for some hours with this improvised gear in position, in order to make observations, it would be a wise precaution to fit brass or bronze bushes in order to avoid causing damage to the journals or pins on which it works.

I am not suggesting that it is necessary to make this rod with a full fork fitting at the front end ; a single-sided rod, cranked a little to restore the working line of the final rod, should fill the bill entirely.

Once the temporary rod has done its work, you will be faced with the problem of transferring the centres so established, to those of the final rod. With one end of the temporary rod cranked out, it hardly forms an ideal jig from which to drill another rod, and it would be better to use an intermediate tool to do this job.

If you take a piece of plate or flat rod, and fit it with a fixed and vertical pin at one end, this pin being a snug fit in the cranked-up end of the test rod, you can then drill another hole through the free end, thus producing two more centres, but both in the same plane ; the fixed pin can afterwards be pushed out, leaving the holes free for this purpose—and there is your jig drilling plate.

Valve Setting

With this engine, fitted with the detachable plug top to the steam chest, the job is made much easier than usual.

When the wheels are rotated, jacked or wedged up to the correct running level, and the radius-rod is held in the mid-gear position, the slide-valve should just uncover a tiny crack at the end of each travel. Adjust the slide-valve nuts provided until such equal movement is obtained. If the setting fails to show any port opening at all, the valve itself must be removed, and reduced *equally* from both ends until this state is reached ; but be careful to remove the surplus metal in easy stages, punctuated by frequent try-outs, as metal removed cannot be replaced, and I know you would simple *hate* to make up new slide-valves at this stage.

(To be continued)

For the Bookshelf

On Railways at Home and Abroad, by P. Ransome-Wallis. (London : Batchworth Press Ltd.) 298 pages, size $5\frac{1}{4}$ in. by $8\frac{1}{2}$ in. Illustrated. Price 15s. net.

There is no stauncher lover of the steam locomotive than Dr. Ransome-Wallis, but he differs from the majority of locomotive enthusiasts in that a steam locomotive anywhere and at any time is a delight to him ; also, in his profession as a medical man, particularly in the Navy during the war, he has had more than usual opportunities of visiting other countries and, with the aid of expert use of a camera, used those opportunities to the full. This book is the result ; full of personal impressions, recollections and experiences, it provides delightful reading for anyone in need of relaxation from daily cares and worries.

We get glimpses of steam locomotives at work in many countries, and the reader is able to see something of the widely varying conditions in which the work is done. Moreover, in most instances, these glimpses are from the footplate, a fact which adds a great deal to their interest ; interspersed among them are some amusing anecdotes.

There are more than a hundred illustrations, nearly all of them reproduced from the author's own photographs, and we are struck with their astonishing variety. The Doctor seems to have been everywhere, and has even found himself *alone* on the footplate of an express passenger train—on the Romney Hythe & Dymchurch Railway ! This may be contrasted with being in the cab of a Delaware & Hudson 4-6-6-4 articulated locomotive, and is typical of the wide range of experience recorded so entertainingly in this book.

PRACTICAL LETTERS

Dangerous Electrical Devices

DEAR SIR,—The major question as to whether articles describing domestic electrical apparatus embodying potentially dangerous features should appear in "Ours" is one which, in the light of recent events, you may wish to reconsider, but, in any case, it is to be hoped that Mr. Stebbings is not really as anxious to liquidate certain members of his family as the design of his hair drier, in your issue of May 31st, last, would suggest.

A short time ago, the author of a scheme for motorising a lawn mower was warned how easily his circuit might make him "very very dead," and surely Mr. Stebbings' hair drier is worse. Moreover, a person actually using a hair drier may be in a particularly vulnerable condition with damp hands and with water taps close by which are not unlikely to be better "earths" than the earth pin of the domestic supply.

Mr. Stebbings points out that his motor is designed for only 24 V, d.c., and that it is not "intended to withstand high voltages." Later, after warning model engineers against varying the method of wiring, he says "the voltage existing between any part of the motor and its casing *cannot ever be much above normal*" (Presumably 24 V.).

Does not Mr. Stebbings realise that any circuit failure in the drier will leave part of it alive and that if, for example, the brush which he shows connected to *N* were to stick in its guide for an instant, the insulation of the motor would not only be subjected to 230 V but to the *maximum* voltage of the a.c. circuit which is nearer 330 than 230?

If the insulation does fail or the device does become "alive," the theory is that enough current will be taken by the earthed pin to blow the fuse without causing the potential of the device to rise appreciably, but it will depend on the thickness of the wire in the fuse holder and on the quality of the "earth" what value it actually reaches.

Unfortunately, there is a tendency to expect too much of the third wire of the house circuit. Normally, there is no indication whether it is in working order or not, and many of us can tell of the "earth" wire found connected to nothing and liable to become "alive" itself at any time.

Apart altogether from the regulations controlling the manufacture of such things, surely common sense would dictate that a hair drier should be completely covered with insulating material of ample thickness and unquestionable quality if it is to be used in connection with the 230 V circuit, yet here we have one recommended as something "useful" (the inverted commas are not mine!) with a metal handle, insulated for 24 V d.c. only, and a heater made from a radio voltage dropper which, if it happened to break, would probably make contact with the frame!

Personally, I would urge Mr. Stebbings to run his drier from a transformer giving the required volts and no more, and to insulate the handle even then. The "resistance-in-series" method of reducing volts is never very satisfactory. The voltage so applied to the motor is not constant, for it depends on brush contact resistance and motor speed as well as the resistance in series.

Yours faithfully,

Lymington A. RICKARD TAYLOR

[While we are in complete agreement with our correspondent, we would like to point out that there are some commercially produced electrical implements on the market which are, in our opinion, more dangerous than the hair drier referred to. After all, Mr. Stebbings was careful to mention certain safeguards, such as proper earthing arrangements, and we feel that if these are provided, the hair drier is at least as innocuous as most.—Ed., "M.E.".]

Rust Prevention

DEAR SIR,—Since I get some of my recreation in a "garden shed" type of workshop, I have followed the letters on "Rust" with considererable interest, and feel that I am probably better placed than most to comment. As far as I can remember, no one has given a full explanation of the cause of the trouble, although Mr Clawson (April 19th issue) has come very near.

Briefly, the air—no matter how dry it may seem—always contains some invisible water-vapour. The quantity of water that can be so held depends on the temperature of the air; the higher the temperature the greater the amount of water required to saturate the air. Incidentally 95 per cent. relative humidity is quite a commonplace occurrence in these islands.

The worst cases of rusting—from my observations—occur when there is an abrupt change in the type or origin of the air, particularly at night. A mass of relatively cold air—often cloudless at night—allows the workshop and its contents to cool. There can then, under suitable conditions, be a fairly rapid transition to a warm and humid air supply, but the temperature in the workshop, particularly that of large lumps of metal such as lathe and shaper beds, and drilling-machine bodies, does not rise anywhere near so quickly. Consequently, the air coming in contact with such tools is cooled to its saturation point and beyond, and copious amounts of water are deposited on the still cold tools, especially on the upper surfaces.

The only certain prevention, short of an indoor workshop, seems to me to be a very well insulated and weatherproof workshop, with some device to maintain the inside temperature a little above that outside, able, if necessary, to raise the temperature very quickly. As my workshop is far from the Utopian edifice suggested, I endeavour to keep rust at bay on my lathe, etc. with enamel on all but working surfaces, and a coating of motor-oil on all bare metal, e.g., my chucks are grey enamel except on the front face and

jaws. The main disadvantage of this coating of oil is that swarf sticks in unexpected places, and I have to be particularly careful when changing chucks or setting-up work.

Yours faithfully,
Collingbourne Kingston. M. E. PITCHER

DEAR SIR,—Mr. Heupy's further letter on the above subject in the May 31st issue shows that he has missed the point of my letter (April 9th). The only thing that prevents his workshop from being ideal is that, being of wood, it is not fireproof. He could, in all probability dispense with his "Sisalkraft" cover without any fear whatsoever.

His reference to the local weather conditions is pointless because, as everyone knows, it only managed to stop raining on rare occasions in London during the first five months of this year.

I still stick by my guns. My workshop is a glass lean-to outside the kitchenette door and contains a gas refrigerator which is continuously pouring forth its quota of H_2O and SO_2. The window over the cooker is permanently open and adds its quota of steam to the air. My equipment is, therefore, hardly more than protected from direct rainfall.

Of Mr. Heupy's geographical situation I am unaware, but mine is as follows:—Two miles direct from the River Thames. Between us and stretching westwards are the Royal Group of Docks. Immediately between us are the gasworks and power stations of Beckton and Barking. These burn over three million tons of coal between them per annum. From there to the east stretches the Dagenham Marshes out to beyond Tilbury. It will be seen that, rain or shine, the air is never dry and always tends to be acidic.

Each case must be taken on its merits and all of the facts analysed. Perhaps Mr. Heupy can explain two of mine for me. (1) Unless my cloth cover is used, material rusts in my shop. (2) In my bedroom which contains the usual quantities of "moisture attracting cloth" stands a partly finished road roller, unprotected in any way at all, which is never affected by rust at all.

To change the subject slightly, "L.B.S.C." has mentioned recently "fuel and power cuts." What are they?

Yours faithfully,
E. Ham., E.6. A. E. CLAWSON.
(A.M.Inst. Mechs., Grad.I.Prod.E., Grad. I.E.D.).

"Britannia"

DEAR SIR,—I would like to answer Mr. C. M. Keiller's letter by saying that my own reaction to the above class of locomotive is far from disappointment, in fact, I find the tendency in motive power policy quite progressive. Mr. Keiller appears to be confused in his ideas of route availability and restriction.

The new engine, to be better available than the other classes mentioned must be built to a slightly smaller height and width (loading gauge), and is less affected by the strength of bridges on various routes, whilst the strength of the track, the least permanent part of the "permanent way," does not come into the picture at all. From Mr. Keiller's remarks about the permanent way department it would appear that he has not noticed the advent of the flat-bottomed rail. Why he suggests a reduction in axle-loading of a mere ton I don't know, but I feel sure that a lower first cost is important, hence I agree that a two-cylinder machine is right. I agree that an engine with a high axle load will be less severe on the track if it is made four-cylinder instead of two. The pounding will be lighter; but is the track not able to stand a greater blow than has been considered desirable for many years due to a definite reason previously stated?

I think the design represents an interesting breakaway from useless traditional ideas whilst still giving us an engine with a "British" look about it. Whilst the "Duchess" and "Royal Scot" class look quite well with an oval chimney, I am pleased with the circular type fitted to "Britannia." A pity that the "4F" 2-6-0s were not so fitted as standard.

I cannot offer any remarks about the regulator nor the bronze slipper on the pistons, but I can answer the last question in the letter and so could any schoolboy who has a mind to study engines. If the lap and lead are measured from the piston rings, why have a piston valve body turned to a micrometer size for slide fit in valve liners?

Yours faithfully,
Bury, Lancs. VICTOR SHAW

DEAR SIR,—I feel that Mr. Keiller's recent letter in THE MODEL ENGINEER regarding the new B.R. "Britannia" class 4-6-2 locomotives, calls for some comment. Most of the points raised by Mr. Keiller are dealt with in Mr. Cox's paper read to the Institute of Locomotive Engineers recently. For the benefit of those readers of THE MODEL ENGINEER who have not access to this valuable contribution to locomotive literature, I would add that the main theme is simplicity of operation and ease of maintenance at all costs.

To one who knows the present depleted state of shed staffs, and the difficulty of getting any but the most urgent, and necessary of running repairs done, it is an apparent paradox that the engine easiest to maintain gets best looked after. I have recently had the privilege of examining the "Britannia" class engines at first hand, from the bare frames and rough castings to the finished engine, and I honestly believe that the detail design reaches heights not before achieved in this country. The whole design bears the mark of careful consideration of all the factors necessary to obtain satisfactory operation under modern conditions. The workmanship being put into "Britannia" and her sisters is superb, and in the best traditions of Crewe Works. The only criticism my driver friends had to make was over the position of the fire-hole door handle, which necessitates the fireman standing in front of the firehole to open or close the door.

I hope that *Apollo*, No. 70015, one of the latest completed "Britannias," that I examined, and the first one to be destined for the Western Region, is well received, and not condemned out of hand because it hasn't got a copper cap

chimney, or a brass coffee pot for the safety valves. However, much we regret the passing of these adornments, they would be out of place on these engines.

Well, I must finish now, as a complete desdription of *Britannia* and all the why and wherefores of the design would fill several issues of THE MODEL ENGINEER.

Yours faithfully,

Bramhall, Ches. WILFRED TUCKER.

Early Wireless Instruction

DEAR SIR,—I read with much interest your paragraph in "Smoke Rings" headed "Amateur Radio in 1898." (May 24th.)

As a schoolboy of 13 years I was a regular reader of THE MODEL ENGINEER AND AMATEUR ELECTRICIAN from 1898 onwards; often, I fear, "under the desk," such was the fascination of your journal.

If you do not regard the article in the first issue as constructional a one in the modern sense, I can assure you it was followed up, about that time, by excellent constructional articles on the building of a 4-in. spark coil and a Wimshurst machine; both of these I made in the school workshop.

With the 4 in. spark coil I built, in 1900, a spark transmitter and coherer receiver with which I was able to signal over a distance of about 20 yards.

About 1903, a book was published entitled *Wireless Telegraphy*. I think the author was S. R. Bottome; it was advertised in THE MODEL ENGINEER and I obtained a copy, now unfortunately lost. This book gave a detailed description of the Lodge-Muirhead system and constructional particulars of the author's installation in North London, somewhere near Enfield, and with which he obtained good communication with a friend about 1¼ miles away.

I constructed the apparatus described, in 1904, again using the "M.E." 4 in. spark coil, and I still have in my possession the Lodge detector, consisting of a revolving knife-edged wheel lightly touching a globule of mercury immersed in oil. With this apparatus I obtained much better results and passed signals over approximately ¾ mile.

Taking the above facts into consideration, I think you would be fully justified in claiming to be the first to instruct the amateur in wireless and it is possible that I, reading your journal, may have been the first "wireless schoolboy."

I have heard it argued that wireless wastes the modern schoolboy's time. Certainly conditions now are very different from my school days when no components could be bought, and much had to be improvised; my de-coherer was made from an old P.O. sounder, bought from a junkshop in the Camberwell Road, and tuning arrangements were of the crudest kind, just a long inductance with a sliding contact.

I spent many hours tapping my coherer in the vain hope of hearing an outside signal, but was the time wasted? I can only say that the early articles you published undoubtedly led to my interest in wireless, first as an amateur and later to a life-long professional career in radio. I am proud to have been a past chairman of the radio section of the I.E.E., the managing director of the Radio Communication Co. Ltd., and in 1922 one of the foundation directors of the B.B.C.

Now I am retired, but I still read and enjoy THE MODEL ENGINEER and still construct some of the many useful things you describe; but I am ever conscious of what I owe to those early articles published in your journal.

Yours faithfully,

Hayes, Kent B. BINYON.

CLUB ANNOUNCEMENTS

The Tyneside Society of Model and Experimental Engineers

Our next meeting will be held on July 7th, when a talk will be given by Mr. N. G. Robson, to be illustrated with photographs, on "Steam Road Locomotives and Steam Wagons," at 2.45 p.m., in the Newcastle Photographic Society headquarters, 6, Rutherford Street, Newcastle.

Hon. Secretary: L. JAMIESON, 34, Dorcas Avenue, Pendower, Newcastle-upon-Tyne, 5.

Bedford Model Engineering Society (Power Boat Section)

The Power Boat Section has arranged for the annual regatta to be held at Longholme Lake, Bedford, on Sunday, July 29th, 1951, to commence at 11 a.m. The following events will be held, if possible, in the order as shown:—

1. Steering competition; 2. "B" class; 3. "D" class; 4. Nomination event; 5. "C" restricted and "C" classes (separate awards); 6. "A" class.

A special invitation is extended to all who came to our first regatta last year, and if club secretaries will contact the undersigned with details of any of their members attending this event by rail, arrangement will be made to meet trains to convey personnel and boats from the stations to the lake.

The regatta is included in the Borough of Bedford's Festival of Britain programme.

Assistant Secretary: K. BROWNRIDGE, 18, Phillpotts Avenue, Bedford. (Tel. No.: Bedford 61092—evenings.)

Southampton and District Society of Model Engineers

An open regatta will be held under M.P.B.A. rules on August 19th, 1951, commencing 11 a.m., at the Ornamental Lake, The Common, Southampton.

Programme. Morning: Steering, nomination. Afternoon "C" and "D" class (separate prize for "D" class); "C" restricted; "B" class; "A" class. Time permitting—Balloon bursting competition.

Trains. Waterloo 8.30—Southampton 10.38; Waterloo 9.30—Southampton 11.25. Van available to meet above trains if previous notice is given.

An added attraction will be the club locomotive track (3½-in. and 5-in. gauges) in operation at the side of the pond giving rides to children. Visitors with engines who wish to run them will be very welcome.

Regatta Organiser: B. J. PILLINER, 2, Thomas Road, North Baddesley, Southampton.

The Edinburgh and Lothians Miniature Railway Club

The inaugural meeting of this club will be held in the Edinburgh Chamber of Commerce, 25, Charlotte Square, Edinburgh, 2. On Friday, July 6th, 1951, at 7.30 p.m.

All those interested in miniature railways, resident in the city, the Lothians or neighbouring counties, are urged to attend and support the new and long overdue society. Those willing to join, but unable to attend, are requested to write to MR. W. LOCH KIDSTON, 6, Chester Street, Edinburgh, 3. S.A.E., please.

Good club premises are being negotiated for.

Eltham and District Locomotive Society

The next meeting will take place at the "Bee-Hive" Hotel, Eltham, at 7.30 p.m., on Thursday, July 5th, which will be a Workshop Discussion night organised by the chairman, Mr. Hutton. Members are asked to bring along their problems for solution.

Visitors are always cordially invited to the meetings.

Secretary: MR. F. BRADFORD, 19 South Park Cres., S.E.6.